ILLUSTRATED
ELECTRICAL REVIEW
A Journal of Scientific and Electrical Progress.

VOL. 22. No. 10. WEEKLY. | NEW YORK, SATURDAY, APRIL 29, 1893. | $3 per Annum. Single Copies, 10 Cents.

Copyright, 1893, by ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

COLUMBIA WINS!

Heinrich Goebel's Lamp Again in Court and the Judge Believes it Preceded Edison's Invention.

THE COLUMBIA INCANDESCENT LAMP COMPANY, OF ST. LOUIS, GAINS A VALUABLE POINT—JUDGE MOSES HALLETT REFUSES TO GRANT AN INJUNCTION AGAINST THE COLUMBIA COMPANY—THE GENERAL ELECTRIC COMPANY EXPERIENCES ITS FIRST SET-BACK IN THE LAMP CONTROVERSY—FULL TEXT OF JUDGE HALLETT'S DECISION.

Judge Moses Hallett, of the United States Circuit Court for the Eastern District of Missouri, in the suit of the Edison Electric Light Company against the Columbia Incandescent Lamp Company for infringement, decided on April 21 that there is preponderant *prima facie* evidence that Henry Goebel was the inventor of an incandescent lamp prior to Thomas A. Edison.

He, therefore, refused to issue an injunction against the Columbia Company provided the latter will give $20,000 bonds to pay any dues that may be decreed to complainant.

The arguments on the petition for an injunction began on Tuesday, April 11, and lasted until Friday, April 14, when Judge Hallett took the case under advisement, announcing that he would probably render a decision within a week. The argument of Mr. William H. Kenyon, for the defense, was one of the ablest yet made in the lamp trials and, doubtless, had much to do with winning the case.

The complainant submitted no less than 222 affidavits, while the defendant had but about 120 affidavits. Abstracts of the more important affidavits submitted by the defendant appeared in the last issue of the ELECTRICAL REVIEW.

Judge Hallett's decision throws the burden of proof on the defendant, and the Columbia Incandescent Lamp Company, after complying with the bond requirement, must produce sufficient testimony on the trial of the case to prove their allegation that Henry Goebel is the inventor of the incandescent lamp for which the General Electric Company now holds a United States patent issued to Thomas A. Edison.

This means a delay of several months at least, as the gaining of time is an important object to the Columbia Company while the odds are so strongly against them. If the Columbia Company wins on the trial, it is but natural to suppose that the General Electric Company will carry the case to the Court of Appeals for final adjudication.

It may be another Bell telephone case. If many delays are obtained the case may run on till the patent runs out.

(*Continued on page* 136.)

VIEWS, NEWS AND INTERVIEWS.

The first message over the Atlantic cable, according to the St. Louis *Republic*, was a dispatch from Queen Victoria to President Buchanan. There were 95 words in the message, but, owing to something getting wrong with the wires, it was 24 hours from the time that the first word was received until the last was taken off. The principal part of the message was the Queen's expression of the wish that the cable would prove a bond of union and a link of friendship between the two great nations. Mr. Buchanan heartily concurred in this wish, and incidentally remarked to her majesty that in his estimation this "crowning triumph of science would prove a greater boon to humanity in general than the results of all the hard fought battles ever won."

Mr. Swan, the English electrician, declared recently that he had seen electrical blowpipes capable of melting the stoutest iron so rapidly that to melt into a fire-and-burglar-proof safe with this fatal instrument would be the work of only a few minutes, and would be both an easy and a noiseless operation. The only drawback to the burglar using such a scientific tool is that a 40 horse-power engine is required before the electrical blow-pipe can work.

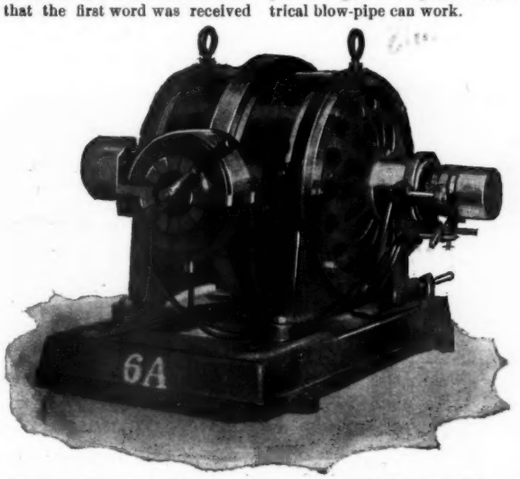


FIG. 1.—STANLEY ELECTRIC MANUFACTURING COMPANY'S QUARTER PHASE ALTERNATING CURRENT MOTOR.—VIEW SHOWING STARTING SWITCH.

A prominent electrical engineer, who has witnessed the process of welding rails by electricity, states this is a decided step in progress in railway construction. The results are very satisfactory and promising, and the additional comfort obtained from riding over continuous rails will be quite an item to be considered when the advisability of adopting it on the principal roads of the country comes up for discussion.

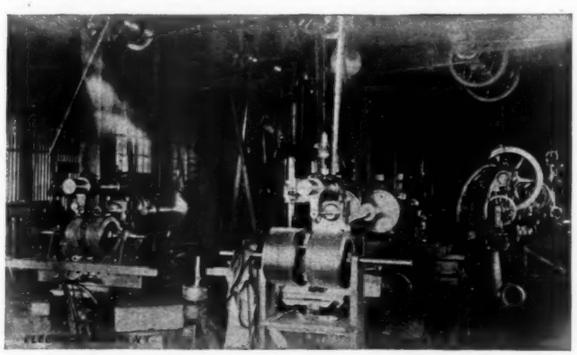


FIG. 2.—MACHINE SHOP.—STANLEY ELECTRIC MANUFACTURING COMPANY, PITTSFIELD, MASS.

The electrical supply works of Henry T. Paiste, on the third floor of the building at 10 South Twentieth street, in Philadelphia, were damaged to the extent of $1,000 last week by fire.

Stanley-Kelly Quarter-Phase Motor.

AN ADMIRABLE SYSTEM OF COMBINED POWER AND LIGHTING DISTRIBUTION IN OPERATION AT PITTSFIELD, MASS.

A representative of the ELECTRICAL REVIEW had the pleasure of witnessing, at Pittsfield, Mass., recently, the new quarter-phase motor now being manufactured by the Stanley Electric Manufacturing Company. This motor is an exceedingly interesting type embracing a number of novel features, and is especially interesting from the fact that it is probably the one type of multiphase alternating current motor which is actually at work in the United States in operating machinery for industrial uses. The entire plant of the Stanley Electric Manufacturing Company in Pittsfield is operated by motors of this type, involving all kinds of machinery, both light and heavy, needed for the manufacture of transformers and other apparatus to which the plant is devoted. The motors in operation in the works of the company for their own service vary in size from two to ten horse-power, and are yielding splendid results. They start immediately under load, and operate all day and all week, as needed, without further attention than cutting on or off the current by means of a simple switch. There is no commutator used, consequently there is no sparking or flashing, and the motor at the end of a day's service is only slightly warm. This type has also been put to service in other manufacturing plants in Pittsfield, a quarter-phase alternating circuit extending from an 80 horse-power generator in the station of the Pittsfield Electric Company for a distance of a mile to different parts of the city. Lamps and motors are operated on the same circuit, which comprises three wires carrying two quarter-phase currents, which are led to a transformer where service is required, and the voltage reduced for supplying lamps or motive power, as may be required. From each transformer run four leads delivering two quarter-phase currents, between the several pairs of which leads are connected the lamps or motors. About 40 total horse-power is used for operating motors. Among these is a seven horse-power motor in the woolen mill of the Pittsfield Manufacturing Company in actual commercial service for operating a number of carding machines in the mill, which is about one mile distant from the supply station. The REVIEW representative had the pleasure of witnessing this motor in operation. It has been in service for some time past, and when seen had been running for about seven hours during that day. Its behavior seemed to be all that could be desired, and the absence of a commutator gave it a distinct advantage even over direct current motors. The woolen company using this machine is so highly pleased that it has ordered another

motor to supplant part of the steam power which is being used in its mill.

In developing this motor the Stanley Company has been but keeping pace with the so-called rotary current systems, generators, lines and transformers disproportionately large to the work necessary to be done. They maintain that a commercial system for

FIG. 3.—EXTERIOR VIEW OF STANLEY ELECTRIC MANUFACTURING COMPANY'S PLANT AT PITTSFIELD, MASS.

growing popular conviction that the multiphase system is the only plan practicable for the successful distribution of light and power by alternating currents, and it maintains that the simplest form of multiphase distribution is the two-phase or quarter-phase system which they now have in operation. The great success of their motor is ascribed to the prevention of false currents, which has been the stumbling block to the commercial introduction of alternating current motors, preventing them from starting with strong torque, and rendering regulation impossible, requiring also, even in the case of the light and power distribution necessitates a motor which will take current proportionate to its load, and that the Tesla and other types of rotary current motors which have recently occupied so large a share of the public attention do not satisfy these needs. The successful tests of the triphase system with Dobrowolsky motors, at Frankfort, gave a strong impulse to the development of alternating current motors, but the low frequency at which that system was operated, about 20 periods per second, necessitated the use of large transformers, which are not in use in this country, where a frequency of 133 periods per second is the common practice, and small transformers are accordingly in use. It is said that the rotary current motors do not yield good service at the high frequency necessary in this country, by reason of the fact that the false currents generated are much greater than if the frequency had been considerably lower, say, seven or eight thousand per minute. The Stanley Company have kept in view the attainment of a system which would permit the operation of lamps and motors on the same circuit at the standard frequency in use in the United States, for the reason that it will largely simplify the solution of the problem of the combined use of motors and lamps on the same circuit, because of the large amount of money already invested in generators and transformers adapted for this high frequency. The motor which they have developed is a joint invention of Messrs. Stanley and Kelly, and the principle of a rotary magnetic field developed by the joint action of two differential phase currents has been abandoned. Each motor is provided with two independent field magnets supplied by two alternating currents a quarter of a phase apart, a condenser being placed in shunt relation to each field magnet circuit, and the armature being provided with a closed coil induced circuit. The condensers remove from the field magnet circuit the lag of current behind impressed electromotive force, by affording as it were a by-path for the false currents due to self-induction; instead of going back through the transformers and the line to the generator and upsetting the whole system, they simply flow in a local circuit through the condensers. A vast amount of energy has been expended in developing a condenser suitable for such use, with the result that they are now made thoroughly reliable at a reasonable cost, not exceeding seven per cent. of the expense of the motor. In the motors already installed these condensers are placed in wooden boxes, a condenser of sufficient size to accommodate a 10 horse-power motor not occupying more than a cubic foot of space; a double condenser, one for each field magnet, is mounted upon a suitable shelf near the motor, or may if desired be mounted in the motor base, as, after being once set up, no further attention is required. Each condenser is sectional, the sections being formed in slabs in which 60 plates of foil about 8x10 inches are separated by a dielectric material, such a slab occupying a space of only half an inch in thickness. The details of the construction of the condenser and the process of treatment are maintained a secret. The slabs may be handled as entireties, and any desired number conveniently mounted, by simply dropping them into a suitable trough or box, and connecting them with the front of the box where fuses are mounted for connecting into the supply circuits. The condensers have the property of thoroughly eliminating the lag in the field magnet circuit. Their importance may be realized from the fact that 500 volts and 4 amperes are required, when they are removed to do the work, which the same voltage at one ampere will do when they are used, leaving the energy consumed in the two cases 2,000 and 500 watts, respectively. In Fig. 4 is shown one of the condensers, as commercially used in this system, showing the arrangement of fuses and the boxing of the condensers.

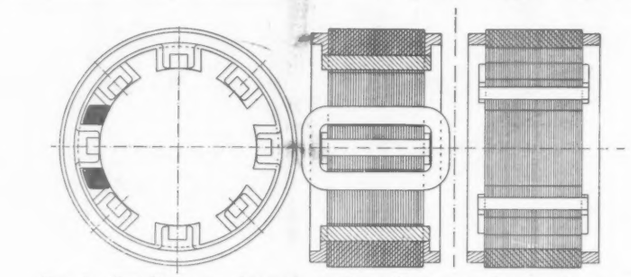


FIG. 6.—END VIEW AND SECTIONS OF FIELD MAGNET OF STANLEY ELECTRIC MANUFACTURING COMPANY'S QUARTER-PHASE MOTOR.

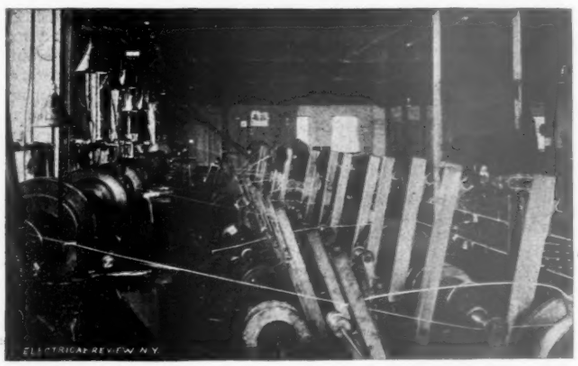


FIG. 4.—WINDING DEPARTMENT.—STANLEY ELECTRIC MANUFACTURING COMPANY.

FIG. 7.—VIEW IN MACHINE SHOP.—STANLEY ELECTRIC MANUFACTURING COMPANY.

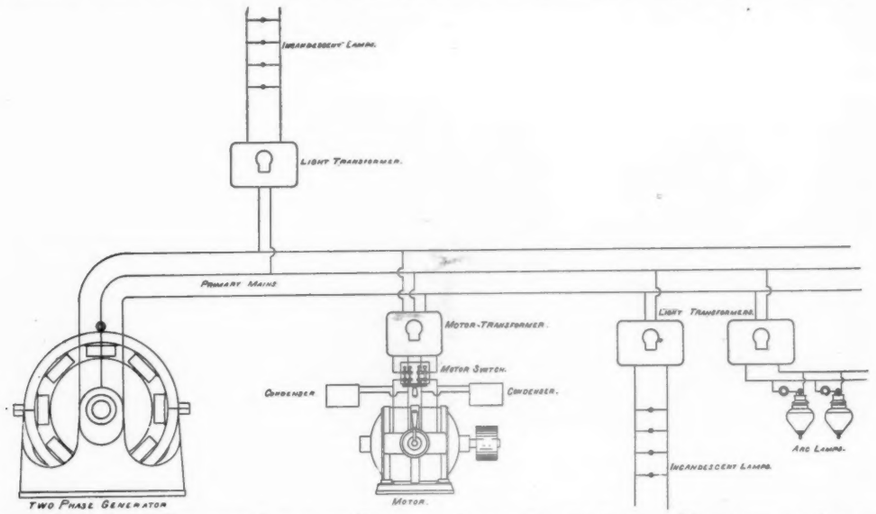


FIG. 5.—ALTERNATING TWO-PHASE SYSTEM FOR POWER AND LIGHT.—STANLEY ELECTRIC MANUFACTURING COMPANY.

To neutralize the self-induction of the armature circuit, which, as stated above, is merely a closed coil placed as a surface winding upon a cylindrical toothed armature, an ingenious system is used, involving what are termed "compensating circuits" placed upon the field-magnet, but so placed that any interference with their action due to the ebb and flow of magnetism in the field-magnet poles is eliminated. These compensating circuits are simply heavy bars of copper which form closed electric circuits fixed in the field-magnets and are

acted upon inductively by the armature, and by reason of the closed circuit permit the flow of current through the latter without lag, acting in a manner similar to the closed secondary of a transformer. The motor will operate efficiently with any frequency, though, for the reasons hereinbefore stated, their use in this country is especially advantageous because of their ability to operate on a circuit carrying 16,000 alternations per minute. An efficiency of 90 per cent. is claimed.

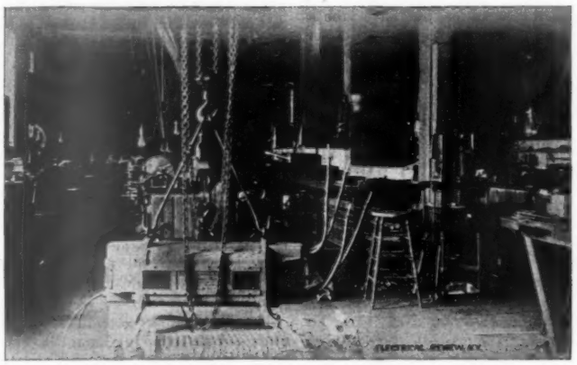


FIG. 8.—TRANSFORMER ASSEMBLING DEPARTMENT.—STANLEY ELECTRIC MANUFACTURING COMPANY.

These motors have been in practical operation, doing work from day to day, for the past six months, and for the past two months the 80 horse-power generator in the Pittsfield station above referred to has been supplying about 40 horse-power of lights and about 40 horse-power of motors, seven of the latter being used in sizes ranging from 10 horse-power down, and not a hitch or accident of any kind has yet occurred. The flexibility of the system is one which will appeal with great force to the central station man. During the day the same generator may be used to furnish light and power, and in the evening when power service is not required the three-wire supply circuit carrying the two quarter-phase currents may be switched to an ordinary single-phase machine at the switchboard. For adapting an existing plant to motor service a third wire may be run to the point at which power is to be delivered. For lighting service the transformer now in use may be used, one of its present connections being broken and led to the third wire. For motor service a special transformer is put in with connections made to all three wires. The lighting transformers will be connected about half and half on each side of the central wire, although delicate balancing of the system is not necessary, it being maintained that it is not nearly so difficult to keep in balance as the Edison three-wire direct current system, and in reality no more trouble to operate than the ordinary single-phase system. A system of this character is better adapted for mixed transmission than direct current, for the reason that the area of distribution may be tremendously increased at but little additional expense in copper; power may be realized without the troublesome commutator; overloading of the motor cannot burn it out, but will simply stop it; no adjustments in the motor are necessary as the machine is provided with self-oiling bearings which need refilling only once in a few weeks. The motor is very compact in design, a 10 horse-power motor only standing about two feet from the floor.

We present herewith, in Fig. 5, an illustration of the system equipped with lamps and motor of the Stanley-Kelly type. In this figure is shown a two-phase generator provided with three mains upon which two quarter-phase currents are delivered. As will be seen, the lamp transformers are connected on opposite sides of these mains, so as to maintain a fairly equal balance on the two sides of the system. Where motor service is required three leads are tapped to the mains and pass into a transformer delivering in its two secondaries two quarter-phase currents upon two pairs of leads running to a motor switch. A condenser is placed beyond the switch across each pair of leads. In starting the motor the switch is thrown and a starting switch mounted on the side of the motor, as shown in the diagram, is shifted over three or four contacts. This starting switch comprises a few segmental contacts respectively leading by conductors to different parts of a steel ribbon coiled upon the back of a slate plaque or slab, upon which the switch is mounted. This steel ribbon is wound double, one pair of ends being connected together and the other to the terminals of the armature winding. The double winding is thus differential and eliminates self-induction. The ribbon is covered with mica cloth, and the switch arm, shown in the drawing, when shifted gradually over the segmental contacts, varies the amount of the steel ribbon in series with the armature circuit. The armature winding leads to the switch and its resistance through three copper rings fixed on its shaft, and thence to the switch by brushes. The function of this switch is not, as in direct current motors, to prevent heating of the machine, but to increase the starting torque. The time elapsing from the interval of closing the motor switch to the time when the motor is in full swing is but a few seconds. The switch leading from the transformer is first thrown, and then the starting switch slowly shifted across its contacts.

In construction the motor is very ingenious. Two independent field-magnet systems are provided, each of which is multipolar in character. In the type shown in the diagram, Fig. 6, eight poles are provided for each field-magnet. These poles are wound with polarizing coils, which are all connected in series for each field-magnet system. Alternate coils are, of course, reversely connected, so as to develop alternately plus and minus polarities in the successive field-magnet poles. The two independent field-magnet systems standing side by side, as indicated in the right-hand portion of Fig. 6, are set relatively to one another, so that the poles are staggered or in *echelon*, and in some types of the motor the compensating coils are placed so that they embrace one pole on one field-magnet frame, and pass centrally through a slot formed in an adjacent field-magnet pole in the other frame. This disposition is for the purpose of eliminating the inductive effect of the field magnet upon the compensating circuit, and the latter is left comparatively free of electromotive forces, except such as are induced by the secondary poles in the armature. Thus there is provided a closed circuit in inductive relation to the armature poles which is analogous in function to the closed secondary of a transformer, and permits a quick flow of the alternating current induced in the armature coils. In other words, these compensating coils eliminate the lag from the armature current, and prevent its being choked off by self-induction, and as the lag has been withdrawn from the field-magnet poles by the condensers, the motor system is in a condition to instantly respond to the reversals of the current. In the type of motor shown in Fig. 6 the compensating circuit in the two field-magnet systems is independent, being composed of copper bars set in grooves in the field magnet pole-pieces, and connected at their ends by copper rings. By so arranging this compensating circuit, a minimum induction due to the field-magnet reactions is realized, and the system is best adapted to perform the function of eliminating lag from the armature. Where, however, as in the types hereinbefore adverted to, the adjacent field-magnet systems are interlinked by the compensating circuits, the staggering of one set of poles with reference to the other permits of the compensating coil being carried completely around one pole piece and medially through the other.

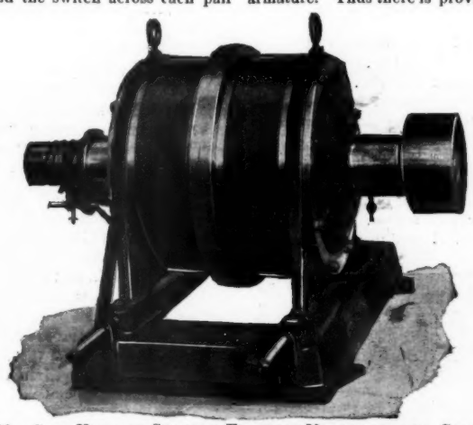


FIG. 10.—SIDE VIEW OF STANLEY ELECTRIC MANUFACTURING COMPANY'S QUARTER-PHASE ALTERNATING CURRENT MOTOR.

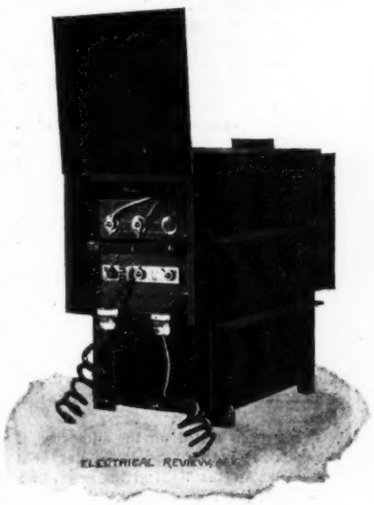


FIG. 11.—COMMERCIAL CONDENSER USED WITH STANLEY ELECTRIC MANUFACTURING COMPANY'S QUARTER PHASE MOTOR.

By the construction herein described it will, therefore, be seen that the quarter-phase currents passing through the two field-magnet systems develop two sets of alternating poles. The elimination of self-induction permits the magnetism of these poles to fluctuate simultaneously with the applied electromotive force; one set of poles may be regarded as contributing to the polarization of the armature, and the other set displaced relatively by the staggering referred to, attracts the induced poles set up in the armature and develops rotation.

There are several highly interesting points in the theory of the motor, a discussion of which will have to be left to a future article.

The practical behavior of the motor is simply admirable. The curves shown in Fig. 3 represent the great importance of condensers in this motor. It will be seen that the difference between apparent and real energy consumed when no condensers are used is very considerable, the curve marked "watts" showing the real energy, and the curve marked "volt amperes without condensers" showing the apparent energy. With condensers, however, the real and apparent energy closely approximate, as indicated in the diagram. It will also be seen that the slope of the curves, when condensers are used of the real and apparent energy, closely approximate to parallelism; whereas, when condensers are not used, there is considerable divergence, which means in effect that the condenser, when placed in multiple arc relation to the field-magnet circuits, puts the motor in a status where it bears, in the relation of energy applied and energy consumed, a close analogy to direct current motors.

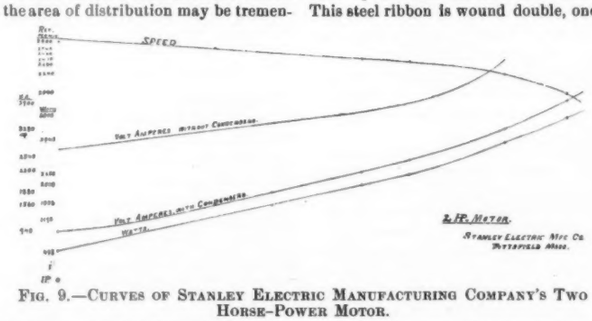


FIG. 9.—CURVES OF STANLEY ELECTRIC MANUFACTURING COMPANY'S TWO HORSE-POWER MOTOR.

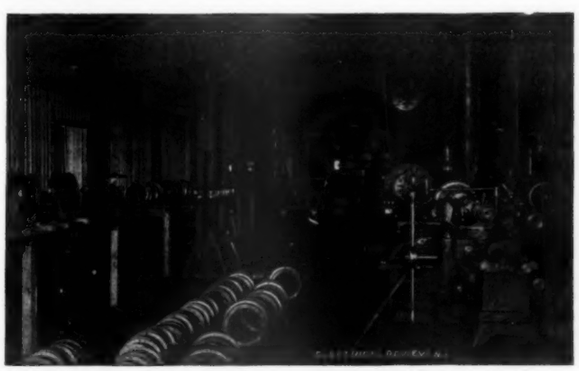


FIG. 12.—MOTOR ASSEMBLING DEPARTMENT.—STANLEY ELECTRIC MANUFACTURING COMPANY.

Gas Glow Burners vs. Geissler Tube Light.

The *Frankfurter Zeitung* publishes a paper by Dr. Ch. Heinzerling and Dr. L. Holthof, entitled "Progress of Modern Illuminants, with Special Reference to the Gas Glow Light of Auer."

The present leading theory of light assumes that it is an undulatory motion of the ether which affects the retina, and that the various colors produced depend upon the period of vibration and wave length of the rays. More modern investigations prove, however, that photometric comparison between the various sources of light as to their useful light producing effects are untrustworthy. The reason is that the distribution of light depends greatly upon the construction of such devices, and that the light effects are much impaired by reflection.

Again, one of the most important factors has frequently been overlooked, *i. e.*, the physiological effect of different rays upon our eye; for example, the yellow and green rays excite them most strongly, and the fairy story about the powerful effect of the light of the fire-fly should be ascribed to that fact.

It has been stated on the authority of Messrs. S. P. Langley and P. W. Very that the degree of the light giving power of a fire-fly was 400 times greater than that of a gas burner. Again, Langley has demonstrated that the different rays have a varying effect upon the eye. Assuming an equal amount of energy consumed in the production of various colors, he gives the following values for light sensation:

Color.	Violet.	Green.	Yellow.	Red.	Dark Red.
Wave l'gth..	0.400	0.530	0.580	0.650	0.750 M*
Lgt sen'tion	1.600	100.000	28.000	12.000	1

These figures are not absolutely correct, because they depend to a certain extent upon the physical construction of the individual eye, but the proportional values of the several colors remain unchanged.

No important discoveries have been made in our method of producing artificial light. Taking measurements made by such scientists as Tyndall, Blattner, Nakano, Nichols, Staun, etc., we obtain the following values, showing the percentage of energy returned as light in the various illuminants:

Oil Lamp	Gas Burner	Incand. Lamp
3	4	5–6
	Arc Light	
Under most favorable angle		Ordinarily
18–19		8–12
Magnesium	Geissler Tube	
15	32	

In other words, 95 per cent. of the energy is lost in incandescent lighting. But this figure does not represent our entire loss of energy. We must also take into account that the machines which produce the electric current use but 10 per cent. of the energy contained in the fuel; that the dynamo returns but 80 per cent. of the energy applied to it; in other words, we have used only one-half per cent. of the original energy.

Among the latest improvements in artificial light devices, Auer's gas glow light plays a leading role. The inventor claims that his light possesses an increased light giving power with a decreased consumption of gas.

An ordinary 16 candle-power gas light consumes 111 litres gas per hour; Auer's glow light (16 candle-power) consumes but 22 litres gas in the same time. Consequently the glow light of equal candle-power develops but one-fifth of the amount of heat given out by the ordinary gas burner, while it is yet 3½ times larger than that developed by a 16 candle-power incandescent lamp.

While much has been said about the cheapness of Auer's glow light, it should be remembered that its first cost is high and that the device is quite fragile. From recent tests it is found that its light capacity rapidly decreases, it being but 50 per cent. of its original value after 500 light hours.

But the greatest drawback to the use of the gas glow light is its greenish-yellow hue, which does not adapt it for the illumination of interior rooms. This objection Auer concedes, but he claims that it is a comparatively easy thing to give the light a yellowish color. A change in color is, however, equivalent to a loss in light power, and thus the greatest advantage of the glow light becomes also its greatest disadvantage.

The following metallic oxides are contained in Auer's glow light: Oxide of cerium, didynium, erbium, lanthanium, niobium, thorium, yttrium, zirconium. The English physicist McKean has carefully examined these oxides as to their light giving qualities. Using a burner consuming 85 litres per hour under a pressure of 25 mm., he finds:

Oxide of	Normal Candles.	Light.
Thorium	31.56	Bluish-white.
Lanthanium	28.32	White.
Yttrium	22.96	Yellowish-white.
Zirconium	15.36	White.
Cerium	5.02	Reddish.

Thus it appears that the Auer glow light has a well circumscribed limit of light efficiency which cannot well be exceeded.

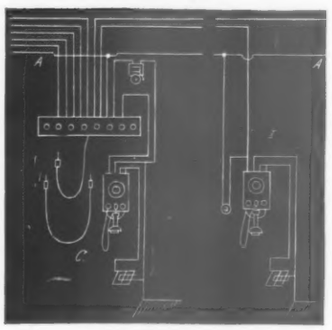
Real progress in artificial lighting seems to lie in the development of the electric light such as is produced in Geissler tubes, which even now return 32 per cent. of the original energy as light. This degree of efficiency can yet be considerably increased by the introduction of calcium sulphide. For the practical solution of the problem, we must turn to the alternating current of high frequency; the world is ripe for the discovery of a Columbus in the realm of electric lighting. Who will be the lucky discoverer?

*M 0.001 mm.

A Novel Factory Telephone System.

The *Elektrotechnische Anzeiger*, for April 2, 1893, contains the subjoined diagram illustrating a telephone factory system invented by Mr. C. Baberstein, member of the firm of H. Gieldzinzki, Berlin.

It is stated that several installations of this kind are already in practical operation, giving universal satisfaction. One of the advantages claimed by the inventor is the cheapness and simplicity of the system. As will be noticed, there is no switchboard proper at the central station. All lines end in plug sockets. In addition to this open



A Novel Factory Telephone System.

wire terminal, each station is connected with a call wire which passes through a plug button placed to the left of the telephone apparatus. The diagram also shows two ringing keys on the face of the telephone box. In calling up the central they are both pressed down, then that to the right is released and the telephone taken from its supporting switch. If one station desires to call another, the right key is pressed. The disconnecting signal is given by two strokes upon the central station bell.

A scheme to supply Seattle, Wash., with electric power from Snoqualmie Falls, 18 miles distant, is said to be in contemplation. It is claimed that from 10,000 to 15,000 horse-power can be obtained from the falls, which is sufficient to operate machinery and street railways in Seattle and several towns along the proposed line from the city to the falls. A number of Pelton or Dodd wheels will be placed at the foot of the falls, and a company is to be formed to build and operate the plant, which will require the expenditure of about $1,000,000.

A Handy Pocket Tool.

A screw-driver and a knife are absolutely essential for every one who is in any way actively connected with any of the electrical trades. We have all been in the position where we were shown some new device put together with screws, and we have hunted through our desks and our pockets for a screw-driver with which to get at the insides of the invention, but have had to use a flat key or knife blade for want of the proper article.

The accompanying cut shows a very handy pocket tool, which is gotten up in three different styles. One has two blades

A Handy Pocket Tool.

—an ordinary knife blade and a combination screw-driver and knife blade, which can be used for stripping wire, etc. Another style has only the combination screw-driver and knife blade, and the third style has a screw-driver only.

These tools are no larger in size than an ordinary pocket knife, and are put on the market at very reasonable prices by Alexander, Barney & Chapin, of New York.

New Incandescent Lamps.

The statement contained in the annual report of the General Electric Company, submitted at the meeting of the stockholders in Schenectady, N. Y., on the 11th ult., to the effect that all efforts to develop a non-infringing incandescent lamp had been thus far wholly without success, and that there was no reason to believe that any different result would be achieved in the future, is now being challenged by several companies.

As a matter of fact, several non-infringing lamps have been brought out within the past few months, and are at the present time being submitted to the severest tests as to their commercial efficiency. Your correspondent has received full information as to the construction and possibilities of two of these lamps, and has seen one of them in daily commercial use, which is guaranteed by the makers to be fully up to the standard of the most efficient lamp heretofore known to the trade.

Nor is this all—there is still another lamp, particulars as to which I am not yet at liberty to divulge, which will be put on the market in the near future, and which, unless all predictions fail, is destined to prove the biggest surprise of anything known in electrical circles for some time.

The truth of the old adage that "necessity is the mother of invention" has been demonstrated many times, and the necessity in this case, at least to those whose entire business future hangs upon the issue, is certainly a sufficient stimulus to urge them to great efforts.

That a new lamp will soon be put on the market is a positive fact, and all statements to the contrary cannot come from any absolute knowledge of the true situation.

Boston, April 22. H. G. T.

Negotiations are said to be in progress for the sale of the Atlanta, Ga., Consolidated Street Railway property, now owned in Boston, to an Atlanta syndicate. Twenty dollars per share is said to have been offered for the control of the stock.

FINANCIAL.

It is reported that the gross earnings of the West End Street Railway Company, of Boston, are still increasing at the rate of about $1,000 per day and that the net earnings are increasing more rapidly than the gross.

There is some quiet talk in Boston relative to a possible reduction in the dividend rate on West End Street Railway common stock. Conservative men believe the stock should stand on a lower dividend basis and eventually sell higher.

One of the "hitches" to the consummation of the West End Street Railway "deal" is said to be the desire of the new syndicate to get President Whitney to retain his present position for a time at least. The latter is, however, anxious to be relieved, and declines to accede to this request. Mr. Whitney has already established an office at 95 Milk street, Boston, and his retirement from the West End Road may now come at any time.

The *Boston News Bureau* for April 20 contained the following item:

A scarlet colored pamphlet containing an advertisement of the bears on General Electric has been distributed to banking houses. It is sufficiently fair to print the full balance sheet of the General Electric, and its comments thereon are fair enough from the point of view adopted. The only "scarey" thing about the pamphlet is the glare of the outside cover.

The points made against the General Electric are that President Coffin and others might sell out their stock, also that there might be another episode like the Baring affair, prostrating general business, also that some German company might elect to do business in the United States, and thereby take away the business of the General Electric.

The pamphlet might have added that the Schenectady factories are not very far from the line of the San Francisco earthquakes, and that the Lynn factories are not 20 feet above tidewater, and 20-foot tidal waves have been known in South America.

But the tides the authors of this pamphlet fear are the business tides of this country, which are rolling into electric lines, and the ground tremors they might fear are those of the financial resources of this country, which topple over the structures of bear operators oftener than they do those of the builders of values.

As a matter of fact, neither President Coffin nor Comptroller Ord are wholly responsible for the very admirable and very conservative financial statements of the General Electric Company.

Some time ago the board of directors constituted Messrs. Henry L. Higginson and T. Jefferson Coolidge, Jr., of Boston, and H. McK. Twombly and C. H. Coster, of New York, a committee on accounts, and it is this committee that has had full charge of the General Electric accounting, and they have devoted a great deal of their time to the subject and have placed the General Electric bookkeeping upon its most conservative basis.

Stockholders of the General Electric may feel that the accounting of that company is certified to by the whole board of directors, and this means a good deal under the laws of New York, and the charter of the company is from that State, but any stockholder can hold either of the above-named directors accountable for any inaccuracies in the General Electric balance sheet, except the generally recognized under-valuation of the company's assets.

TELEPHONE NOTES.

The new telephone company to be started at Decatur, Ill., has 385 subscribers to begin with.

Aurora, Neb., expects to have a local telephone exchange soon and connection with neighboring cities.

Now, that the Chicago Twin Wire and Long Distance Telephone Company has secured a franchise as long as its name, the citizens of Chicago will watch with interest for its absorption by the Bell Company.

The Telephone Subscribers' Protective Association, of Baltimore, Md., proposes to secure signatures to a petition to the governor asking that the attorney-general be instructed to file a bill in court requiring the Chesapeake and Potomac Telephone Company to show cause why its charter should not be annulled. It is claimed that the company has failed to comply with the provisions of the law passed at the last session of the legislature limiting the rate to be charged subscribers for instruments.

Triumphs Yet Ahead.

BY EX-SENATOR JOHN J. INGALLS, IN THE NEW YORK "COMMERCIAL ADVERTISER."

Man, having conquered the earth and the sea, will complete his dominion over nature by the subjugation of the atmosphere. This will be the crowning triumph of the coming century. Long before 1993 the journey from New York to San Francisco, across the continent, and from New York to London, across the sea, will be made between the sunrise and sunset of a summer day. The railway and the steamship will be as obsolete as the stage-coach, and it will be as common for the citizen to call for his dirigible balloon as it now is for his buggy or his boots. Electricity will be the motive power and aluminium or some lighter metal the material of the ærial cars which are to navigate the abyss of the sky.

The electric telegraph will be supplanted by the telephone, which will be so perfected and simplified that instruments in every house and office will permit the communication of business and society to be conducted by the voice at will from Boston to Moscow and Hoang-Ho as readily as now between neighboring villages.

This will dispose of the agitation of the propositions to take the railroads and telegraphs away from those who own them and give them to those who do not.

Domestic life and avocations will be rendered easier, less costly and complex by the distribution of light, heat and energy through storage cells or from central electric stations, so that the "servant problem" will cease to disturb, and woman having more leisure her political and social status will be elevated from subordination to equality with man.

The contest between brains and numbers, which began with the birth of the race, will continue to its extinction. The struggle will be fierce and more relentless in the coming century than ever before in the history of humanity, but brains will keep on top, as usual. Those who fail will outnumber those who succeed. Wealth will accumulate, business will combine, and the gulf between the rich and the poor will be more profound. But wider education and greater activity of the moral forces of the race will ultimately compel recognition of the fact that the differences between men are organic and fundamental—that they result from an act of God and cannot be changed by an act of Congress.

The attempt to abolish poverty, pay debts, and cure the ills of society by statute, will be the favorite prescription of ignorance, incapacity, and credulity for the next hundred years, as it has been from the beginning of civilization. The condition in the United States is unprecedented, from the fact that all the implacables and malcontents are armed with the ballot, and if they are unanimous they can control the purse and the sword of legislation, but the perception that the social and political condition here, with all its infirmities, is immeasurably the best and will undoubtedly make our system permanent, and preserve it even against essential modifications.

Our greatest city in 1993? Chicago. It is a vortex, with a constantly increasing circumference, into which the wealth and population of the richest and most fertile area of the earth's surface is constantly concentrating. When this anniversary returns, Chicago will not only be the greatest city in the United States, but in the world.

MOVING TIME.

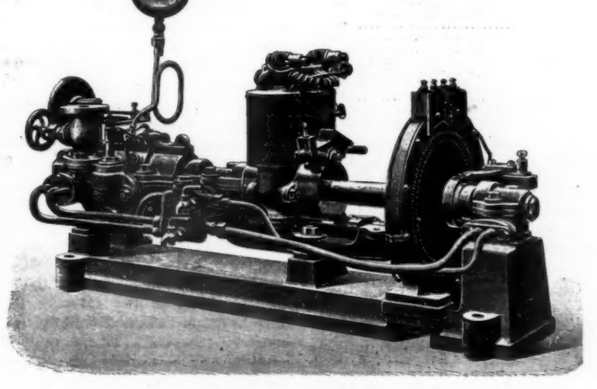
In accordance with our annual custom, we shall be glad to publish announcements of the removals of those of our friends who expect to make changes in locations on or about May. 1. Send us your old and new addresses as soon as you have decided upon your new quarters, and we will chronicle the change in our issue for May 6. Copy of this character should reach the ELECTRICAL REVIEW office not later than May 1.

Parsons' Turbo-Motor.

The steam turbine combined with two dynamos on one shaft, which we illustrate on this page and for which illustration we are indebted to London *Engineering*, has been presented by Messrs. C. A. Parsons & Company, of Newcastle, to the engineering laboratory of Cambridge. Its chief point of interest is that one of the dynamos, designed by Professor Ewing, has a periodicity of 14,000 complete cycles per second at 12,000 revolutions per minute. The steam turbine has a normal speed of 12,000 revolutions, and is coupled directly to the dynamo shaft.

There are two distinct dynamos—one of the usual two-poled type, with a continuous current armature, for an output of 15 amperes at 100 volts, with 12,000 revolutions per minute. This armature may, at will, be converted into an alternator by slipping two contact rings on to the commutator, each ring being connected to diametrically opposite segments of the commutator and insulated from the others, the magnets being in this case separately excited. An output of 20 amperes at 40 volts, with a periodicity of 200 cycles per second, is obtained.

Professor Ewing's dynamo is complete in itself, and is bolted on to a prolongation of the bed-plate. The field magnets, which revolve, consists of two mild steel disks laid together, but insulated from each other and forming one disk, which is of conical form, thickest near the axis, to give it strength to resist the centrifugal force due to its high speed of rotation. The edge of this disk is sawed into 140 projecting teeth, and the exciting coil consists of an insulated strip of copper wound zigzag around between the teeth and held in place by a ring of projecting lips formed by turning a low fillet on the side of each disk just at the circumference. The ends of the exciting coil are connected respectively to the two disks. An exciting current is supplied from an external source to two brushes rubbing on the disks. Each alternate tooth is thus magnetized north and south respectively. The armature is formed of about 60 thin charcoal iron disk rings about 0.01 inch in thickness built up into a cast-iron frame. The rings are bored to $\frac{1}{32}$ inch larger than the magnet



PARSONS' TURBO-MOTOR.

disks, and sawed radially by 140 cuts three-eighths inch deep, thus forming 140 poles around which the armature wire is wound.

It will be seen that there are 70 complete cycles of current per revolution, and at 12,000 revolutions per minute this gives 14,000 complete cycles per second.

The output is about five amperes at 100 volts. It is, we believe, intended to carry out a series of experiments on the physiological effects of alternating currents of high frequency, as well as other interesting investigations.

There was a civil service examination at the Brooklyn Navy Yard last week for the place of electrician, recently established by Secretary Herbert, with a salary of $1,200 a year. Of the 40 applicants, 21 answered each question correctly.

Indian Grass Grows Through a Cable.

A member of the Institute of Electrical Engineers, Mr. P. V. Luke, sends from Calcutta, India, a photograph and description of a piece of cable which passed through a curious experience. The picture on this page shows a piece of the india-rubber cable (Hooper's core) through which a root of grass has grown, and illustrates one of the dangers to which underground wires in India are subject.

It came about in this way: The piece of core in question, after being treated with a composition said to be a preservative against white ants, was buried, unprotected by any armor, in soft, damp soil at Calcutta for six months to see what happened. On the

GRASS GROWING THROUGH A CABLE.

piece of core being dug up, the grass was found to have grown through it as shown in the illustration.

What at first sight appears to be an impossible performance on the part of grass seems less so when it is stated that the roots of this species of grass are characterized by very hard, sharp, needle-like points.

Bipolar vs. Multipolar Machines.

Herr E. Schulz, a German author, evolves from calculations from actual machines the general considerations which affect the question, and shows that the armature reaction in multipolar machines is a much more serious matter than in two-polar dynamos, quoting Mordey and Andrews to confirm this view. He comes to the following conclusion: (1) The two-polar type is the only one which can be constructed without the extravagant use of iron; (2) the constant sparkless position of the brushes is more easily attained in the two-pole machine than in any other; (3) the four-pole type for given speed and given weight has 36 per cent. greater output and is, therefore, more suited to slow speed machines; (4) for large machines the multipolar type surpasses the two-polar for low tensions, as the limit caused by the small number of armature conductors is so soon reached in the latter type and would be thus more suited for purposes of electrolysis.

LITERARY.

We have received "Transactions of the American Institute of Electrical Engineers," for April, 1893.

"Journal of the Institution of Electrical Engineers," for April, 1893, has come to hand, together with an index to vol. xix and a list of members and officers corrected to January 31, 1893.

ELECTRIC RAILWAY AND POWER NOTES.

Wichita Falls, Tex., is to have electric lights.

Danbury is the latest Connecticut town to adopt the trolley cars.

Jacksonville, Fla., has made the change from horses to trolley.

The Haverhill and Salem, Mass., electric road is to be built at once.

An electric railroad is to be built between Ellicott City and Middletown, Md.

There are now three applications for electric road franchises in Pasadena, Cal.

Hopkinton, Ashland and South Framington, Mass., are to be connected with electric cars.

Work was commenced at Norwalk last week on the Sandusky, Huron and Milan, O., Electric Street Railway.

The present street railway of Fort Worth, Tex., will be merged into an electric line in the near future. A party of capitalists from Kansas City have the deal in hand.

The Baltimore Traction Company last week obtained a permit for the erection of an electric power house on Charles street, between Conway and Barro streets, 82 feet by 87 feet.

The Niagara town board has granted a franchise to the Niagara Falls and Buffalo Electric Railroad to lay tracks from the easterly limit of the city of Niagara Falls to the town boundary.

Olean, N. Y., is to have electric cars running before the first of June. Four cars, their motors and the most of their equipment, including a 134 horse-power generator, have arrived and the rest are expected soon.

Work will be begun at once on the new Lynn, Mass., gas and electric power plant. The contract has been awarded to E. E. Strout. The dimensions of the building will be 155x160. It will have a chimney 150 feet high.

City Treasurer McCreary, of Philadelphia, received last week from the Traction Company $28,890 in dividend taxes for the following leased roads; West Philadelphia, $6,300; Philadelphia city, $7,290; Union, $11,700; Continental, $3,600.

A bill has passed the general assembly of Ohio compelling every company operating motor or grip cars to protect the motorman or gripman with a screen constructed of glass or other material during the months of November, December, January, February and March.

The Giant Electric Motor Company, of Portland, Me., has been attached for $22,000 by the assignee of the Atkinson Company. Isaac C. Atkinson is the principal stockholder in the motor company. The assets are about $40,000 and the liabilities are said to be fully up to that figure.

Reardon & Ennis, of Troy, N. Y., have received the contract to ventilate one of the main buildings of Dannemora prison with an electric ventilator. The contract is a large one. The firm supplied nine large ventilators for the Niagara Falls Paper Company, one of the largest mills in the country.

A number of Pittsburgh and Cleveland capitalists are figuring on connecting the two cities by an electric railroad, to be run over almost a direct route on country roads. The details are being kept under cover, but it has been learned that the route has been figured out, and is almost an air-line. It is only 110 miles, against 130 traversed by the Cleveland and Pittsburg Railroad.

In granting permission in Connecticut for the establishment of a general trolley system, the legislature makes stipulation that the roads shall not carry freight or express packages. This is in the interest of the steam railroads. There is no such provision in the laws relating to electric transit recently enacted by the New Jersey legislature, and the traction companies will not be inhibited from using their roads for freight and express purposes.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 3329. NEW YORK.

EDITOR:
CHARLES W. PRICE.
ASSOCIATE EDITORS:
STEPHEN L. COLES.
ROBERT H. READ.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.
1546 "CORTLANDT," TELEPHONE CALL.

BOSTON OFFICE:
H. G. TUCKERMAN, Room 29, 620 Atlantic Ave.
CHICAGO OFFICE:
MERWIN J. BULKLEY, 435 "The Rookery."
WASHINGTON OFFICE:
GEO. C. MAYNARD, 1409 New York Ave.

ADVERTISING DEPARTMENT,
H. T. RICHARDS, Manager.

PATENT BUREAU,
ROBT. H. READ, Manager.
Patents procured in United States and all foreign countries. Searches, investigations and Reports on Validity and Infringement.

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.
One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - .10

NEW YORK, APRIL 29, 1893.

CONTENTS.

	PAGE
Columbia Wins!	129
Views, News and Interviews	129
Stanley-Kelly Quarter-Phase Motor	129
Gas Glow Burners *vs.* Geissler Tube Light	132
A Novel Factory Telephone System	132
A Handy Pocket Tool	132
New Incandescent Lamps	132
Financial	132
Telephone Notes	132
Triumphs Yet Ahead	133
Moving Time	133
Parsons' Turbo-Motor	133
Indian Grass Grows Through a Cable	133
Bipolar *vs.* Multipolar Machines	133
Literary	133
Electric Railway and Power Notes	133
The St. Louis Lamp Decision	134
Electric Wiring and Insurance	134
Letters from a Laboratory	134
Correspondence:	
Our Boston Letter	135
How to Ascertain Candle-Power	135
Country Roads and Electricity	135
The Lady Electricians' Union Holds an Important Meeting	135
Personal	135
What is Thought of the Case in St. Louis	136
What Edison's Counsel Say	136
Westinghouse Asks an Injunction Against the General Electric	136
An Early Account of Goebel's Lamp	136
Commercial Candle-Power of Arc Lights	137
Our Chicago Letter	137
General Notes	137
Death of Grosvenor Porter Lowrey	137
Storage Battery Cars on Second Avenue	137
Wall Street and the Electrical Stock Market	138
Electric Light Flashes	138
The "Hunting" of Parallel Alternators	138
Advance Information	139
The Use of Accumulator Substations in Electric Lighting	139
Bliss Press with Automatic Index Feed	139
The United Electric Improvement Company	139
Kindred Interests	140
An Interesting Electrical Exhibit for the World's Fair	140
Electrical Patents	x
What Ampere Means	x
The Lead Pencil Better than Pen	x

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE
American Electrical Works, insulated wire	i
Ansonia Brass & Copper Co., wire	xvi
Armington & Sims, engines	xvi
Babcock & Wilcox Co., boilers	xvi
Beatey, Geo. A., engines	i
Bliss Co., E. W., foot and power presses	i
Brush Electric Co., apparatus	xv
Campbell Electrical Supply Co., insulating tape	i
Crocker-Wheeler Motor Co., motors	i
Day's Kerite, insulated wire	i
Dwight Slate Machine Co	xvi
Eastern Electric Cable Co., insulated wire	xvi
Eddy Electric Mfg. Co., motors	i
Empire China Works, porcelain specialties	xvi
Faraday Carbon Co., carbons	xvi
Hampson & Co., E. P., engines	xvi
Holtzer-Cabot Electric Co	xvi
Jewell Belting Co., belts	xvi
Lake & Co., J. H. & D., pulleys	i
Massachusetts Chemical Co., insullac	i
Mather Electrical Co., power generators	i & ii
Moore, Alfred F., wire	xvi
Okonite Co., insulated wire	i & xvi
Otis Bros. & Co., elevators	xvi
Paine & Ladd, patent attorneys	i
Riker Electric Motor Co., motors, dynamos	i
Simplex Electrical Co., insulated wire	i
Waterhouse, Gamble & Co., arc lamps	i
Westinghouse Electric & Manufacturing Co.	xv
Weston Engine Co., engines	i
Wilmot & Hobbs Mfg. Co., bell gongs	xvi

INSIDE PAGES.

	PAGE
Alexander, Barney & Chapin, sal ammoniac	vi
Allis & Co., Edward P., engines	v
American Bell Telephone Co	xiii
American Fluoride Co., fluoride	xi
Baker & Co., platinum	x
Ball Engine Co., engines	x
Ball & Wood Co., steam engines	ix
Barrett, John A., electrical engineer	x
Berlin Iron Bridge Co., iron roofs and buildings	xi
Billings & Spencer Co., tools, etc	140
Bishop Gutta Percha Co., insulated wire	ix
Blaisdell & Co., tools	xi
Brill Co., J. G., tramway cars	xiv
Bryant Electric Co., switches and sockets	viii
Buckeye Engine Co., engines	xi
Butler Hard Rubber Co., battery cells	v
Carpenter Enamel Rheostat Co., rheostats	xiv
Case Engine Co., J. T., steam engines	viii
Central Electric Co., supplies	xiii
Chicago, Milwaukee & St. Paul Railway Co.	ix
Clark Electric Co., arc lighting	xiii
Conover Mfg. Co., condensers	xi
Cowles Electric Smelting & Aluminum Co., aluminum	vi
Cutter, George, electrical supplies	viii
Dixon Crucible Co., belt dressing	xiv
Dunderdale, F. C	xiv
Edison Decorative and Miniature Lamp Department, incandescent lamps	140
Electric Construction and Supply Co., Ward arc lamps	iii
Electric Gas Lighting Co	vii
Electric Selector and Signal Co	vii
Electrical Specialty Co., switches	viii
Electrical and Mechanical Engineering and Trading Co., contractors	xiii
Electro-Light Engraving Co., engraving	xiv
Elektron Mfg. Co., motors	viii
Falls Rivet & Machine Co., friction clutches	v
Fidelity Carbon Manufacturing Co., carbons	140
Fort Wayne Electric Co., slow speed alternator	v
General Electric Co., inc. lamps	xii
General Electric Launch Co., electric launches	vii
General Incandescent Arc Light Co., arc lamps	vi
Gleason Manufacturing Co., E. P., electrical appliances	vii
Greeley & Co., The E. S., supplies	v & xiii
Harrisburg Foundry & Machine Works, engines	xi
Helios Electric Co., arc lamps	vii
Holmes, Booth & Haydens, insulated wire	xiv
Hulbert Fence and Wire Co	xiv
Iron Mountain Route	vi
Johns Mfg. Co., H. W., vulcabeston	vii
Laird & Lee, books	xiv
Law Battery Co., battery supplies	140
Leavitt Motor Co., motors	vii
Leclanche Battery Co., batteries	ix
Lehigh Valley Creosoting Co., creosoted lumber	xiv
Leffel & Co., James, water wheels	xiii
Marshall, Wm., condensers	xi
May Bros	x
National Pipe Bending Co., feed-water heater	ix
New England Butt Co., braiding machinery	xiv
New Jersey Lamp & Bronze Works, electric and gas fixtures	ix
New York and Ohio Co., incandescent lamps	viii
New York Belting and Packing Co., rubber belts	xi
New York Electrical and Development Co	vi
New York Insulated Wire Co., wires and cables	vii
Onondaga Dynamo Co., electrical apparatus	vi
Ostrander & Co., W. R., supplies	xiv
Palmer Bros., engine castings	140
Partrick & Carter Co., electrical supplies	x
Penn Life Co., insurance	140
Phœnix Glass Co., electric light globes	xiv
Phosphor Bronze Smelting Co., castings	xiii
Queen & Co., electrical instruments	x
Reed & Co., F. E., lathes	xi
Rhode Island Tool Co., tools	viii
Ridlon & Co., Frank, general machinery	xi
Ries Electric Specialty Co., regulating socket	xiv
Robinson & Orr, steel rails	140
Rosenbaum, Wm. A., patent attorney	x
Royce & Marean, electrical supplies	v
Samson Cordage Works, braided cord	xiv
Schuyler Electric Co., arc lighting	v
Shawmut Fuse Wire Co., fuse wire	xi
Shoemaker, Homer, attorney and counsellor-at-law	xiv
Siemens & Halske Electric Co., electrical machinery	iii
Standard Paint Co., insulating compounds	xi
Stocking, E. B., patent attorney	x
Tyndall, Wm. D., attorney	x
Walworth Mfg. Co., trolley poles	iii
Washburn & Moen Mfg. Co., wire	x
Westinghouse Electric and Mfg. Co., electrical apparatus	iv
Western Electric Co., supplies	iii
Weston Electrical Instrument Co., measuring instruments	viii
Wightman Electric Mfg. Co., auction sale	140
Whitney Electrical Instrument Co., instruments	viii
Wilson, Fremont, electrician	x

The West doesn't seem to be a respector of judicial decisions of New York and Boston.

In the death of Grosvenor Porter Lowrey the legal profession parts with one of its ablest members, and the electrical field loses a legal friend who had a wonderful grasp upon matters electrical.

THE ST. LOUIS LAMP DECISION.

The decision of Judge Hallett, refusing to grant to the Edison Electric Light Company a preliminary injunction against the Columbian Incandescent Lamp Company constitutes the first real victory which the outside lamp manufacturers have gained in the long fight over the incandescent lamp patent. This decision allows the case to be tried upon its merit, and it now falls upon the Columbia Company to prove, by testimony, that Henry Goebel ante-dated Thomas A. Edison in the invention of an incandescent lamp formed of an all-glass globe containing a high resistance carbon burning *in vacuo*. Doubtless the Columbia Company will take ample time in the preparation of testimony, so as to make their case as strong as possible. If they win on the trial, the Edison Company will naturally carry the case to the Court of Appeals. So that the electrical field will again witness a lengthy legal battle. "Outside" lamp manufacturers are, of course, jubilant over Judge Hallett's decision.

Meanwhile, reliable manufacturers are reporting from several directions that non-infringing lamps will soon be placed upon the market.

A *fin de siecle* example of the irony of fate is afforded in the following press dispatch from St. Louis under date of April 22:

"Proceedings were begun yesterday against 100 local corporations, representing nearly $5,000,000 capital, to declare their charters invalid because of violation of the Missouri Anti-Trust law. Included in the number are the Evening Chronicle Publishing Company and Columbia Incandescent Lamp Company, which yesterday won the big victory over the Edison Electric Light Company."

While the Columbia Company is fighting an alleged "trust" on the incandescent lamp question, it is itself attacked as a "trust." Of such is the kingdom of electrical progress.

ELECTRIC WIRING AND INSURANCE.

The fire losses during the last three months in the insurance world have been quite heavy, amounting to about $45,000,000. If the proportion were continued, this would mean a yearly destruction by fire of about $180,000,000 of property. This enormous loss is naturally worrying the insurance companies, and they are keenly on the lookout for new and unexpected causes. The fact that this is an increase over last year's losses makes them believe that some very recent cause is at the bottom of it all, and forthwith appears the following report from New York city:

"A leading insurance man says that for the six months ended December 31 insurance companies of this city received in premiums about $3,000,000, and paid out in losses about $5,000,000. The losses came principally from electric wires and lights in buildings. For this reason the insurance companies have raised the insurance rates from two cents to 25 cents on each $100."

This rather astonishing statement naturally leads us to inquire into its authenticity, and another report comes, as it were, to counteract the bad effect thus produced, which reads:

"*Fire and Water* says returns from 76 cities for 1892 show that there were 1,230 fires. Of the losses due to these fires only one-fourth of one per cent. was caused by electric wires. Of all other causes that of these wires was the smallest."

It is obvious that these opinions differ most materially, and as the subject is one about which no definite conclusion can be reached, opinions will continue to differ. There, however, seems to be a decided impression among prominent officials in insurance circles, to the effect that electric installations increase the hazard on fire risks. It is a difficult matter to get down to the root of the question in this abstract subject, wherein statistics are the only means of furnishing any information, and even their application is entirely theoretical. But let us take a few facts, which in a statistical way are about as authentic as any others that can be obtained.

After a collective canvass of several prominent insurance officials, the following figures, which may be liable to fluctuation, were obtained. It is estimated that about 75 per cent. of the fire losses are due to "causes unknown." Since the extensive installation of electric light and power plants, it is imagined that about 25 per cent. of the losses have as their origin imperfect wiring, and of this 25 per cent. two in 30 have been traced directly and positively to defective electrical construction. By simple calculation we find that the proportion of fires caused undoubtedly by defective electrical construction is 1¼ per cent. Thus we see that the apple of discord is imperfect wiring, and as soon as this factor is eliminated the risks attending electric light and power installations will be practically *nil*. It should, however, be stated that the quality of wiring work is improving daily.

The insurance companies are, however, "reaping the whirlwind" from the policies on plants which were wired three or four years ago by incompetent men, for they claim fires are continually resulting from imperfect insulation and bad joints. The companies now refuse to grant policies unless all rules laid down for perfect wiring are rigidly complied with, and it follows as the night the day that with better insulation and more careful work electrical installations will be recognized as *the* safe system, and will be looked upon with greater favor by the insurance men.

LETTERS FROM A LABORATORY.—XLII.

BY JULIAN A. MOSES.

Glass is a substance which, as the glass-blowers say, has a will of its own. It is very often difficult to tell how a particular piece is going to act under certain conditions, even after having tested other pieces of the same "batch." When subjected to heat, one end of a tube will sometimes respond differently from the other end. This is in a measure due to unequal chilling, occasioned possibly by a sudden draught of air while it is in process of manufacture. No piece of glass is absolutely reliable. Its working is, therefore, at certain stages, most uncertain, and one person may have entirely different experiences from another. It is chameleon-like, and every process succeeds better with those who seem to have a knack which is generally obtained by long practice.

The cutting of glass heads the list of the uncertain processes, for it has no definite cleavage and its separation is modified by the surrounding temperature. The simplest separation is on flat glass in a straight line. Here, all that is necessary is a deep and regular scratch with a glazier's diamond, a firm and steady bend away from the main piece, and the parts crack along the desired line. These glazier's diamonds may be purchased and generally prove satisfactory, but it is more economical to purchase from some diamond cutter a small splinter and insert this into a piece of brass rod having a small hole drilled into one end. The splinter should now be cemented with marine glue, and the brass rod filed a little upon the side nearest the ruler, to obtain, after trial, the best cutting angle for the diamond.

Another instrument for cutting glass, less expensive than the diamond, is the glass-blower's knife, which is a piece of thin steel tempered glass-hard by heating it cherry-red, and then plunging it into ice cold water or mercury. The edge should be sharpened by rubbing it upon an old, rough emery grindstone until fine saw-like notches appear. It is then ready for use, and should, if much used, be sharpened repeatedly.

To cut tubes, carefully scratch, at right angles to the axis a deep notch, either with the diamond, triangular file or glass-blower's knife. Heat a piece of glass rod until a small globule appears on the end, and press this upon the scratch. The glass will thus be heated more at this point than at any other; an unequal expansion takes place, the scratch giving direction to the line of fracture, and the tube cracks evenly, if its thickness is uniform. In case of variable thickness uneven edges result, and these must be filed down to avoid the sharp cutting splinters.

Many recipes and directions have been given for cutting bottles, and in many cases the only successful person has been the writer. Wetting an asbestos string with turpentine and setting it on fire produces considerable heat in the glass immediately underneath it. By quickly removing the string and plunging the bottle into cool water, the unequal strain takes place and the parts separate. It is this locating of the heat that causes the glass to crack as we wish it. The easiest method, if the means be at hand, is to employ a platinum wire which should be heated white hot by the passage of a heavy electric current. By wrapping this wire around a heavy bottle or jar and allowing the current to pass for 10 or 15 seconds, the stoutest walled vessel may be easily separated if touched on the heated line with a cloth dipped in water. Melted glass drawn out into a fine string and wound one turn around a bottle is another means for localizing the heat. To cut complicated shapes of glass plate is a more difficult matter. The following method has been used but is not always successful: Mark out the shape to be cut and scratch it on the glass with the diamond. Pour plaster and sand on both sides of the glass, over the places to remain intact, and scrape off all of the solidified plaster sharp to the edges. Cut away, using the diamond, as much superfluous glass as can possibly be removed with straight line scratches and with a red-hot pointed piece of iron follow as near as possible the line of the scratch, which outline acts as a barrier and prevents the cracks from spreading inside to the surface which is also protected by the non-conducting plaster.

CORRESPONDENCE.

OUR BOSTON LETTER.

The Lynn and Boston Railroad Company are expecting to begin work almost immediately on the extension of their lines in Swampscott, and as soon as orders are received to go ahead, work will be pushed forward with all possible speed.

The Milford and Hopedale Electric Company are preparing plans and specifications for a new building to be erected in the vicinity of its present plant, and bids for its construction will be asked for in a few days. The new building will materially increase their facilities for the manufacture of their storage battery.

The Whitney Electrical Instrument Company, of 146 Franklin street, this city, have just shipped a very handsome mahogany show board to Chicago, on which will be displayed a full line of their finest instruments at the World's Fair. Among these is an entirely new alternating current voltmeter which is bound to attract considerable attention.

The Lowell, Lawrence and Haverhill Electric Railway Company have acquired the rights, property and franchise of the Haverhill and Groveland Street Railway Company and the Merrimac Valley Company, of Lawrence. The companies will retain their separate names although united under one arrangement. Work on extensions of the lines through Lawrence, Bradford and North Andover will be started immediately, and the company have purchased a tract of land in Haverhill on which to erect a large car shop.

The Many Friends of Mr. Philip M. Reynolds, treasurer of the Brown Electric Company, of this city, will be pleased to hear of the happy consummation of a very important event in his life, which occurred at Langwood on the 18th ult. Mr. Reynolds is now a benedict, and the bride was Miss Mary B. Gardner, daughter of Mr. Harrison Gardner, the well known dry goods merchant of Boston. After the ceremony a reception was held at the residence of the bride's parents, which was largely attended. On their return from their wedding trip the young couple will make their future home in Milton.

For Some Time Past the West End Company have been experimenting in conjunction with the New England Telephone Company on various methods of controlling their return current, not only as a means of saving them a very large item of expense through loss of energy at terminal points, but to obviate as much as possible the damage to gas and water pipes through electrolysis, caused by contact with the electric current in the earth. The telephone company was also interested from the fact that their service was materially interfered with by this wandering current, and both companies combined to overcome the difficulty. This has been accomplished in a great measure through the use of heavy underground and overhead cables, composed of many strands of copper wire. Thousands of dollars have been expended in this undertaking, but the results obtained have fully justified the outlay, and it is asserted that the loss of current has now been reduced to about the minimum.

A Device for obviating the danger arising from the liability of the trolley wheel of electric cars to jump the wire at crossings, has just been invented by an employé of the Consolidated Railway Company, of Worcester, Mass., and is to be used on the crossings of the company in that city. At a point a short distance from the railroad tracks, at each end of the crossing, is an iron bracket supported by guide wires at the sides of the street. These brackets are provided with galvanized rubber insulators, and support another bracket of composition metal, the ends of which hang down three inches below the ears, which follow the trolley wire and support it. The ears are at the top of the bracket, each end of which supports another wire three inches apart. Thus over the railroad tracks are three wires containing the current, the trolley wires, secondary wires, ears and lower bracket, all being in connection. The trolley wheel runs between two auxiliary wires and in contact with the main wire. Should it jump the last, it will still receive the current through contact with the others, for the jar is never sufficient to throw the trolley pole down more than three inches. It is an impossibility to stall a car when this device is used.

An Important Event in eastern electrical circles was celebrated in Providence on the 15th ult., in the formal opening of the new store of the Drake, Payson & Whittier Electric Company, of that city.

The affair passed off very pleasantly, and the members of the firm are to be congratulated on the exceedingly large representation of their friends among the fraternity who gathered from all over New England to aid in the celebration, and extend their best wishes for the success of the enterprise.

The store was handsomely decorated with potted plants and flowers, conspicuous among which were several large pieces, one from the Eddy Electric Manufacturing Company, of Windsor, Conn., one from the Pettingell-Andrews Company, of Boston, and one from the employés of the firm.

From the hour of the opening, 4 P. M., until nearly 11, the spacious store was crowded with a constantly changing throng of people, all of whom were pleasantly entertained, and found much to admire in the display afforded them.

The interest of the guests centered chiefly in the exhibit of Eddy motors and generators. They presented quite an imposing array, varying in size from one-half to 15 horse-power. One of the latter was in operation, furnishing current for the 60 odd lights by which the store was illuminated. A small motor was also used to drive a stationary engine in one of the show windows, a feature which attracted considerable attention.

The store has a floor area of 30x110 feet, and is well finished and lighted throughout. One special feature is a handsomely fitted up dark room, 15x20 feet, containing an extensive line of gas and electric fixtures to be displayed under artificial light, current for the latter being furnished by one of the machines in the store. The offices are located in the rear, and the remainder of the floor space is occupied by a stock of general electrical supplies of all kinds.

The members of the firm are John I. Drake, S. R. Payson and R. H. Whittier, all of whom, as was most clearly demonstrated, are both well known and popular among the trade. They already control the bulk of the best trade, not only of the city of Providence, but of the State, and with their new location and excellent facilities for handling business, will undoubtedly make themselves felt ere long in a considerably larger territory. H. G. T.

Boston, April 22.

How to Ascertain Candle-Power.

TO THE EDITOR OF ELECTRICAL REVIEW:

Kindly advise me what method to pursue to ascertain the correct candle-power of arc and incandescent lights, or to whom I can apply for such information. Who is authority upon this subject? Yours truly,

JULIUS PINNEY.

Willimantic, Conn., April 18, 1893.

[Bunsen's photometric apparatus is the simplest for this purpose and consists of a standard source of illumination, a candle, a paper diaphragm, having a circular spot of paraffine or other permanent grease in the middle, and the light to be tested. When the lights balance, *i. e.*, when both sides of the paper diaphragm are equally illuminated, the spot disappears and nothing but the plain paper is seen. The distance of the paper from each light is now ascertained. To calculate the result, remember that the intensity of the light decreases as the square of the distance. For example, if the distance from the candle to the diaphragm is one foot and from the diaphragm to the light tested is four feet, the candle-power of the light would be 4 squared = 16 candle-power. This test must, of course, be conducted in a dark room, or at night, and the candle should be protected from draughts and be of the kind known as the "standard candle."—ED. ELECTRICAL REVIEW.]

Country Roads and Electricity.

A writer in the *Scientific American* argues against extravagant expenditure on country roads, and states that at present the electrical manufacturers are overburdened in filling orders for street railways, and they are compelled to continually enlarge their plant to meet the demand. But in the course of a few years—four or five years at the utmost—the urban and suburban demand will be pretty generally met, and the orders will begin to fall. Then we can look to see the next step taken. It would not be consistent with the character of the American manufacturer to abandon a portion of his plant when the whole continent remains to conquer. He will push out into new fields, and invade the country. The country stage coach has gone. The country road must follow, and it is not believed that it would be sensible to bond the State of New York for $10,000,000 for such roads, when in less than 25 years, at the furthest, they will have become a tradition, and the bonds alone would remain as a memento. A $5,000 a mile macadamized road would be no better foundation for an electric railway than a dirt road. It would not be so good.

The Lady Electricians' Union Holds An Important Meeting.

Lovely woman is becoming so rapidly emancipated and has won her way into so many fields of labor hitherto occupied exclusively by men that the formation of the Lady Electricians' Union, of New York city, has not received that mention in the public press which its importance warrants.

The idea of a protective and beneficent society composed of the leading lady electricians of the metropolis has been bubbling in the brains of a few women for some months, and has at last come to fruition. The Union was organized at the dress goods bargain counter at Macy's a week ago last Saturday, by four lady electricians, who experienced a magnetic attraction induced by reading advertisements in Friday's papers. The organization was perfected on the impulse of the moment, and officers were elected at once. The Union has not, as yet, adopted a constitution and by laws, but they will come in the course of time.

The first business meeting of the Lady Electricians' Union was held last Saturday evening, the members following the example of the opposite sex and choosing Saturday evening so as to have Sunday to recover their normal status.

Mrs. Delia Lafferty, proprietor of the "Venus" electric corset and President of the Union, called the meeting to order and said:

"Lady Electricians: Oi notice in the back part av the room, behoind th' shtove, what looks loike a loive man. Oi'll foine th' lady who brung 'im here twinty dollars, anless he is removed this minute. An' Oi've said and troth to it."

The reporter for the ELECTRICAL REVIEW, at whom this sally was aimed, felt compelled to protect his hostess of the evening and came forward to explain that he floated in with the tide, that he had no ulterior motive in being present, and that he would remain behind the big stove and promise not to look if the President would let him stay. After putting the question to vote it was decided that if the reporter would "put their names in the paper" he might remain—if he didn't use his eyes too much.

"Now, ladies," said President Lafferty, "havin' disposed av th' men, we will proceed to business. I desoire to shtate that the 'Venus' electric corset ——"

"I thought this was a protective union," began Mrs. William Ramsaye, meekly.

"Well," said the President, "if the 'Venus' corset ain't protective, Oi'll ate two av thim."

This unanswerable logic gained the floor for President Lafferty, who then proceeded as follows:

"As I wuz sayin', the 'Venus' electric corset is a great deloight to fiminine hearts. (Applause.) An', besides, the current which chases around yure waist and up an' down yure spine afther you have put it on constitutes a counter electromotive foorce which will be found valuable to counteract anny ill effects ye may get from wearing crinolean shkirts under an electric loight. An' Oi hope yez all are hardy women and will wear crinolean shkirts, as it is the new fashion to do."

"I dink der Bresident bin using dis sociedy to make some sales alretty vonce, of her gorsets, by chimminy," remarked Mrs. Heinrich Weisenschnipper, whose claim to membership in the Union lies in the fact that her husband is a firemen in a big electric light station up in Harlem.

"Oi haven't th' anner av th' lasht speaker's acquaintance," remarked President Lafferty, "but all th' same, Oi would loike to politely inform her that her remarks are very much out av order, and will not appear on th' minutes av this meetin'."

"Mrs. President," came in a high bass voice from the back row. The President, grateful for a change of subject, smilingly said:

"Mrs. Ophelia Lanworthy has th' flure, ladies."

"Mrs. President and ladies," began the latest speaker. "I have noticed in my reading, lately, that some of our scientific papers are disputing the accuracy of the Rev. Mr. Ohm's law. For the benefit of some of our newer members, I will explain Ohm's law." This was said with a condescending glance at the audience. After adjusting a large silver hair pin in her Psyche knot, Mrs. Lanworthy continued:

"In my exposition of this fundamental law of electrical science, I will assume a concrete example as better adapted to the purposes of elementary instruction, ahem! This law, as you are all doubtless aware, states that the current is equal to the electromotive force divided by the resistance. Now, if I am using my Dr. Dewlap's electric hair brush, and my husband uses his electromotive force to make me desist, the current flowing from the brush to my hair will be proportional to the resistance I offer to his efforts. Or, to put it algebraically——"

"Mein Gott in Himmel! Vas ist los mit Lanworthy?" came from the direction of Mrs. Weisenschnipper. "It vas beer time, alretty quick, now, I'm dinkin'."

"Ladies," came in a masculine voice from behind the stove. "If you will permit me, I will be charmed to have some cold tea sent in from the corner sal—grocery, I mean."

"Motion seconded and carried unanimously," snapped President Lafferty. And as the REVIEWITE sneaked out to make his promise good, the hubbub sounded like a Fifth avenue five o'clock tea.

VOLTABOUT.

PERSONAL.

Mr. D. D. Dickey, of the Faraday Carbon Company, Jeannette, Pa., sailed for the Bahamas last week.

Superintendent Gill, of the Philadelphia office of the Western Union Telegraph Company, has just returned from Florida.

Mr. Franklin Leonard Pope, the well known patent attorney and electrical expert of this city, has been elected a member of the Electrotechnischer Verein, of Berlin.

Mr. W. S. Hine, general sales manager for the J. T. Case Engine Company, of New Britain, Conn., has just recovered from an attack of *la grippe* and is again in harness.

Mr. J. N. Pratt, the wide-awake general manager of the Jarvis Engineering Company, of Boston, passed through the metropolis last week, stopping long enough to greet a few of his numerous friends.

Mr. C. O. Baker, Jr., the well known platinum refiner, of Newark, N. J., sailed for New York on the "Paris," last Saturday. Mr. Baker will have an interesting voyage, as it is expected that the "Paris" will race with the "Campania," the new Cunarder, on this trip.

Mr. Eugene F. Phillips, president of the American Electrical Works, of Providence, was discovered in his New York office Wednesday of last week, half concealed behind boxes of paint and step ladders, utensils of the artists who were transforming his New York office into a bower of beauty. Mr. Phillips is noted for his cheery disposition, and on this occasion more than ever had he reason to look pleased, for an apple of an order for $150,000 worth of trolley, feeder and cable wire for the great Union Railroad Company, of Providence, had just been dropped into the successful American Electrical Works' basket. The Union company comprehends the street railway system of Providence, Pawtucket and East Providence, and is one of the big electric railway deals of the day.

The new Philadelphia Electric Traction Company, organized by the stockholders of the Frankford and Southwark, will probably lease the latter, guaranteeing about $15 a share on the stock. In addition to this, the stockholders of the Frankford and Southwark will have the privilege of subscribing for the stock of the new company share for share. The company will have an authorized capital of $10,000,000. The People's Traction Company, in which the Drexels are interested, announces its intention of proceeding with the work of trolleying the system regardless of the opposition of the stockholders of two of the leased lines.

COLUMBIA WINS!

(Continued from first page.)

FULL TEXT OF JUDGE HALLETT'S DECISION.

HEINRICH GOEBEL.

In the Circuit Court of the United States for the Eastern Division of the Eastern Judicial District of Missouri.

Edison Electric Light Company *et al*, *vs.* Columbia Incandescent Lamp Company *et al.* (No. 3,707.)

Opinion of the court, April 21, 1893.

Henry Hitchcock, solicitor for complainants.

F. P. Fish, C. A. Seward and R. N. Dyer, of counsel for complainants.

Boyle & Adams and Fowler & Fowler, solicitors for defendants.

Witter & Kenyon, of counsel for defendants.

Hallett, District Judge.

Complainants allege infringement of letters patent No. 223,898, issued to Thomas A. Edison, January 27, 1880, for an improved electric lamp. This patent came under the consideration of the Circuit Court of the Southern District of New York, in the case of the Edison Electric Light Company *vs.* the United States Electric Lighting Company (47 F. R. 454), and was held to be for a lamp "consisting essentially of a filamentary carbon burner, hermetically sealed in glass vacuum chamber." So understood, it is the incandescent lamp in common use, and no question is presented in this record as to the character of respondents' manufacture. The defense to the bill and to the motion for preliminary injunction now under consideration is want of novelty in the Edison patent. Respondents aver that an incandescent lamp different in form, but in all essential features the same as that now in general use, was made as early as 1854 by Henry Goebel, of New York city, and that it was used by him in various ways and at different times for many years thereafter. It will not be necessary to describe this lamp at length, as it has the same constituents as the Edison lamp. We are at present more concerned in the struggle between the contending forces, on the one side to maintain, and on the other to disprove, the existence and use of the lamp anterior to the date of the Edison invention. A large mass of testimony in the form of affidavits is offered by each party on the question of fact, which, to consider at length, would be a tiresome and unprofitable task.

The principal objection urged by complainants against the Goebel invention is that it has an impossible date; no man could make it in the time and manner assigned to it; the incandescent lamp is the product of several auxiliary arts not likely to fall within the compass of a single mind; as an achievement of science the lamp is a matter of progressive steps, some of which must be made by the world at large before others can be taken by any one. This is no more than to say that no man can outrun his competitors to any great length in the field of scientific investigation—a proposition which has no support in reason or experience. There seems to be no reason for saying that Goebel could not reach in 1854 the point attained by Edison in 1879, unless, as was said by the dissenting justices in the telephone cases:

"It is regarded as incredible that so great a discovery should have been made by the plain mechanic, and not by an eminent scientist and inventor."

In so far, however, as it may be shown that the methods adopted by Goebel were not equal to the results obtained, the evidence should receive the most careful consideration. On this point it appears that Goebel has recently made several lamps of the form and with the material and tools formerly used by him. These lamps were tested by men of skill and experience in such matters, and they were found to be reasonably effective. They are not so good as the lamps in common use, but they can be operated, and they give reasonable service in time and capacity of light; so that in this way we have *prima facie* proof of Goebel's ability to make lamps in the way he claims to have made them before the time of Edison's invention.

It is said that Goebel is involved in contradictions and misstatements of facts due to the lapsing memory of old age or to untruthfulness. Be it so; he does not appear to be an adventurer or an imposter. It is not reasonable to believe that he made the story related in his affidavit and did not make the lamp he has described. Whatever may be said as to Goebel's veracity, he is supported at many points by witnesses of good repute, who speak with precision and apparently with deliberation. As already suggested, it is not necessary or profitable to go over the testimony at length with a view to determine the relative value and weight of every part. It is enough to say that there is a fair preponderance of testimony in support of the Goebel claim.

There is not the measure of proof demanded by complainants' counsel, who maintain that the court should require proof of the fact beyond reasonable doubt. This degree of certainty is not often attained upon testimony in the form of affidavits where the issue is contested. And it is not reasonable to demand such certainty as to the defense. Complainants must show a clear right in support of a preliminary writ, and a defense which puts the case in doubt is sufficient to defeat the application.

Goodyear *vs.* Dunbar, 1 Fisher, 472.

Glaenzer *et al. vs.* Wiederer *et al.*, 33 Fed. Rep., 583.

Fraim *vs.* Sharon Valley Malleable and Gray Iron Company, 27 Fed. Rep., 457.

Cary *vs.* Domestic Spring Bed Company, 26 Fed. Rep., 38.

Robinson on Patents, Sec. 1,171.

It is also contended that the decree of the Circuit Court of New York against the United States Electric Lighting Company sustaining the patent, which decree has been affirmed by the Court of Appeals of the Second Circuit, is conclusive of complainants' right to the writ for which they now ask. No doubt is entertained as to the conclusive effect of that decree here and elsewhere, as to all matters in issue in that cause. For although respondent was not a party to that litigation, the Court would not, on a preliminary motion, consider any matter which passed to judgment in that suit. But the Goebel defense was not made in that suit, and, therefore, the case has not the authority on this motion which has been ascribed to it. National Hat Pouncing Machine Company *vs.* Hedden *et al.*, 29 Fed. Rep., 147; Lockwood *vs.* Faber, 27 Fed. Rep., 63; The Bailey Wringing Machine Company *vs.* F. F. Adams *et al.*, 3d B. and A., 96.

Another suit by the complainants against Beacon Vacuum Pump and Electrical Company in the Circuit Court for the District of Massachusetts is in a different attitude. In that suit the Goebel defense was made, and, upon motion for preliminary injunction, recently heard and allowed, it was overruled. It is contended that the ruling in that case should be recognized and followed as a precedent in respect to the present motion. And, perhaps, if the issue, the testimony and the situation of the parties appeared to be the same in both cases, such result might follow—more from the persuasive effect of the opinion of another court on the same matter, than from any motion or authority ascribed to such opinion. In courts of equal jurisdiction, proceeding concurrently in the investigation of the same subject, the right and duty of each to exercise independent judgment cannot be denied. That they should in the end reach the same result is greatly to be desired, but one cannot become an echo to the other for that praiseworthy purpose. In this instance the consequences to flow from diverse opinions are not regarded as serious. In the Massachusetts Circuit, and here as well, the motion is interlocutory; and in each case the ruling may well enough stand upon the situation of the parties. And we have much additional testimony to that upon which the court acted in the Beacon case; so that upon all points I do not feel compelled to accept the opinion of the court in that case.

The ruling of the court, however, in the Beacon case suggests the propriety of taking security from respondent for observing the decree in case complainants shall ultimately prevail in this suit. There are other considerations also which should have weight in that direction. It was suggested by complainants' counsel that respondent is a concern of small capital, and that it is made so with intent to avoid responsibility in respect to the infringement now alleged against it. This was not denied and I suppose we may take it to be true. The retort was in the form of a charge against complainant that it used its monopoly of electric lamps to control the sale of all kinds of electric machinery and apparatus. This charge also passed without denial, and it is not difficult to conceive of circumstances in which it would be necessary to ascertain whether it is true. Referring only to the charge against respondent of sufficient capital and assets, the duty of the court is plain to provide for the contingency of a decision against it. It need not refer to the possible effect of cross-examination in the case of a multitude of witnesses. What now seems plain enough may altogether disappear and new facts may come to the surface under that crucial test.

The injunction will, therefore, be refused if the respondents shall give a bond in the sum of $20,000, conditioned for the payment of such sum (if any) as may be decreed in favor of complainants on the final hearing of this case. The bond to be filed with the clerk of the court, and to be approved by the clerk or by a judge of the court, within 20 days from this day.

What is Thought of the Case in St. Louis.

[From the St. Louis *Star-Sayings*, April 21.]

J. L. Rhotehamel, president of the Columbia Electric Light Company, expresses great satisfaction in the decision just rendered and has no fear of the final hearing. His company was very much handicapped in collecting the evidence which was presented in this case, on account of the fact that a great many people were interested in the General Electric Company, either by association with them or for the reason that they sold them goods, or purchased of them, and they were afraid of affecting their individual interests. With the final hearing, and this decision in favor of the Columbia Company, the matter will be reversed, and witnesses can be compelled to testify and produce exhibits by subpœna from the court. This Mr. Rhotehamel regards as the greatest victory in electric affairs since the establishment of the electric lighting system, and says it means the downfall of the "trust," which sought to compel users of electric lamps to buy apparatus manufactured by the General Electric Company, or what is generally known as the trust. If they bought apparatus from outside parties they would decline to sell them lamps, hence the importance of the decision can be readily seen.

President Rhotehamel is being congratulated on all sides over the victory achieved by his company in the United States Court this morning. It is conceded by everybody interested that but for the untiring energy of Mr. Rhotehamel the case would probably have been decided the other way. It was he who collected the evidence upon which the case was founded. He made four trips to New York, and visited other cities as well, in search of evidence and testimony, working night and day to achieve just what happened this morning. Mr. Rhotehamel felt from the outset that his company had the best of the case, because he considered that it was in the right, but he realized that, in order to establish this fact, it would be necessary to produce the evidence before the court, which was supposed to know nothing about the matter save what the evidence showed. President Rhotehamel is naturally greatly elated over the success of his company, and is perhaps the happiest man in St. Louis to-day, feeling that his indefatigable efforts in behalf of the Columbia Company having been rewarded, entitle him not only to accept the congratulations of his friends, but to congratulate himself upon the victory.

What Edison's Counsel Say.

The counsel for the plaintiff in the Columbia Lamp suit declare that Judge Hallett's decision will not affect the Edison interests in any other section of the country.

What the next step in the suit on the part of the plaintiff will be is not yet decided upon, but eventually, since the burden of the proof rests with the Columbia people, testimony will be taken and the Goebel witnesses will be subjected to the usual severe cross-examination. The decision being solely of local importance, lamps can only be made by other manufacturers within the jurisdiction of Judge Hallett's court. However, it is presumed that the $20,000 bond required by the terms of the decision will fully cover whatever profits may be made by the defendants.

Westinghouse Asks an Injunction Against the General Electric.

George Westinghouse, Jr., applied on Monday last in the United States Circuit Court, New York, for an injunction restraining the General Electric Company from using a device in the manufacture of electric convertors patented by him.

That is an interesting and quaintly told bit of history republished in this issue, taken from the columns of the REVIEW of 11 years ago. Heinrich Goebel seems to have been in the incandescent lamp business at that time.

An Early Account of Goebel's Lamp.

In the ELECTRICAL REVIEW for May 15, 1882, the following account of Henry Goebel's incandescent lamp was published. In the light of modern times this "technical" description reads a little strangely, but nevertheless interestingly:

A NEW INCANDESCENT LIGHT.

A GERMAN ELECTRICIAN'S INVENTION—DISCOVERIES IN THE FORMATION OF CARBON.

Henry Goebel, a German electrician, exhibited recently, at No. 468 Grand street, an incandescent electric light, embracing various new features, of which he is the inventor. Eight three-quarter lamps were placed on exhibition worked by a two horse-power. The lamps gave forth a clear white light, no vibration or flickering being perceptible. The most delicate shades of color were distinguishable under the light of the lamps. Mr. Goebel claims for his light that it has the highest resisting power of any electric light yet invented. The chief feature of his light is that it has a carbon of high resisting power which at the point of junction with the wire is increased in a fluid, of Mr. Goebel's invention, which is specially adapted to resist the action of heat. The carbons are formed from fibres of reeds, which have been reduced in a furnace of a high degree of heat. They are then bent into any shape desired, and sunk into platinum, which is covered with the fluid adapted to resist heat which Mr. Goebel has invented. With these ingredients Mr. Goebel claims to have produced the best incandescent light yet invented. The electricity is generated in the usual way by means of steam engine and dynamo machine. Mr. Goebel states that his light has twice the resisting power of any light yet produced, and that under the rule that the greater the resisting power the less the cost. He can furnish the light at a lower cost than is involved by the use of gas. The light is capable of sub division by disconnecting switches, on the same principle as turning the top of a gas lamp. The cost of the lamps is a little less than 25 cents each. Several well known electricians have seen the light and are very much impressed with it. Mr. Goebel has also invented, in connection with the light, an improved vacuum pump based on the Geissler system of vacuum pumps, but adapted to render the operation of the same mechanical, so that unskilled hands can operate the pump and evacuate electric lamps and other vessels in a rapid and reliable manner.

The invention consists of a Geissler pump provided with an air-discharge valve at its upper end, the whole structure being supported on a pivoted frame, which is oscillated by means of a hand lever so as to throw a body of mercury into a trough-shaped horizontal portion of the vacuating tube and form therein a mercurial seal. The mercury receptacle connected with the pump is adapted to be raised to the proper height by a suitable mechanism, until the surplus mercury passes through a discharge valve at the top of the pump, and then back again by a connecting-tube to the vertically placed mercury receptacle. Upon the lowering of the mercury receptacle the pump is returned into its normal position and is ready for evacuation. Mr. Goebel states that the main advantage of this improved vacuum pump is that it contains no ground-glass stop-cock, which is always a source of leakage. Another advantage of this pump is that its operation is entirely mechanical, and it can be tended by inexperienced hands, which is an important feature when large numbers of electric vacuum lamps have to be evacuated.

Mr. Goebel has been experimenting in the past 30 years in electricity. He states that he invented an electric light 29 years ago, which he exhibited on the roof of his house, No. 271½ Monroe street, this city. On the first evening that he did so, he says, the fire alarm was sounded and the engines came around to his house, and he was arrested and taken to the police station on a charge of disorderly conduct. He was, however, discharged an hour later by Justice Wood, to whom he explained the origin of the light, and that he had merely exposed it for the purpose of experimenting with it in the open air. Since that time he has frequently become impoverished by his electrical experiments, and has more than once given up his attempts in this direction in despair. He says that the electric light is by no means as new an invention as it is popularly supposed to be, and that 44 years ago he knew of a professor in Hanover, Germany, who invented a good electric light, but who died while striving to overcome the difficulty of producing it upon a commercial basis. Mr. Goebel has a number of patents covering all the points necessary to the production of his lamps.

Commercial Candle-Power of Arc Lights.

Professor Elisha Gray, chairman of the Committee on Electrical Congresses, World's Columbian Exposition, has received the following communication:

Dear Sir—A great deal of confusion is still caused by the term 2,000 candle-power, 1,200 candle-power, etc., in referring to arc lights.

In a good many instances this *commercial* term has been the cause of litigation between electric light contractors and purchasers of arc light apparatus. We beg to refer, in this connection, to a few paragraphs taken from Prof. Elihu Thomson's paper read before the National Electric Light Association, Providence, R. I., February, 1891.

It is well known that the value of an arc light for general illumination is greatly enhanced by the fact of the distribution of light being mainly in a downward direction in continuous current arcs. This of course follows from the fact of the positive carbon crater being above, such crater being the part from which most of the light comes.

This matter has been quite thoroughly investigated and many diagrams of distribution are to be found in the literature of the subject, as published from time to time. They show that with the long arc the maximum intensity of light is from 40 degrees to 60 degrees downward from the horizontal, and that the horizontal intensity is generally much less than one-half as great, while of course the intensity diminishes above the horizontal direction and ultimately becomes zero before reaching the upward vertical direction. In like manner the approach to the downward vertical from the direction of maximum intensity is attended with similar rapid diminution.

The spherical candle-power of arc lights would, therefore, be only a fraction of the rated candle-power, which is generally taken at the maximum light obtainable in the best direction from the particular arc or kind of arc in question.

For this reason the term 2,000 candle-power arc has little significance as indicating the illuminating power of an arc. It is now generally taken to mean an arc with 10 amperes and not less than 45 volts potential difference between the carbons, or a 450 watt arc. The quality of the carbons will determine whether the 450 watts will be expended in obtaining the most light or not, or whether that light will have a maximum intensity at one angle or another within certain limits."

As a matter of fact, all attempts made by purchasers of electric arc apparatus to measure what they usually term the actual candle-power of arc lamps, have been dismal failures, as there are only a few of the best fitted laboratories in this country in possession of instruments by which they can determine the mean spherical candle-power of an arc.

In this connection we draw the attention to an article of M. Blondel, which appeared in *L'Industrie Electrique*, from which it is evident that it is absolutely necessary to define the general *commercial* terms, 2,000 candle-power, 1,200 candle-power, etc., in practical electric units.

It is for the reasons stated above that the undersigned ask you to kindly take this question up at the coming Electrical Congress during the World's Columbian Exposition, and have the *commercial* terms mentioned above defined as follows:

"The term 2,000 candle-power arc to mean an arc produced by 10 amperes and 45 volts potential difference between the carbons, or a 450 watt arc. The candle-power of arcs produced by currents of more or less amperes or more or fewer volts difference of potential to be rated proportionally."

Such a definition would at once call a halt to all disputes on this question, and would enable every station superintendent, by simply employing a standard amperemeter and a standard voltmeter, to determine whether or not the electric contractor has fulfilled the conditions of his contract as to candle-power or not.

Yours respectfully,
BRUSH ELECTRIC CO.,
S. A. Douglas, Dist. Mgr.
SOUTH SIDE ELECTRIC CO.,
W. H. Harding, Mgr.
WESTERN ELECTRIC CO.,
C. D. Crandall, Mgr.
GREAT WESTERN MFG. CO.,
A. K. Gilman, Bus. Mgr.
STANDARD ELECTRIC CO.,
D. P. Perry, Mgr.
GENERAL ELECTRIC CO.,
B. E. Sunny, Western Mgr.
CHICAGO ARC LIGHT AND POWER CO.,
C. H. Wilmerding, President.
CITY OF CHICAGO, ELEC. DEPT.,
John P. Barrett, Supt.
THE CHICAGO EDISON CO.,
Samuel Insull, President.

Chicago, April 17.

OUR CHICAGO LETTER.

A New Line of flush switches will be brought out by Geo. Cutter early in May. There is a great demand for such switches.

The Strike in This City of the electrical workers is still on and notice has been given to several construction companies whose men are now working that unless their demand is granted the men will go out.

The Central Electric Company are preparing for a big spring trade, and are now making some very low prices on porcelain blocks, rosette cut-outs, key sockets and switches. They also expect a fine trade in fan motors this summer, and will carry a large number in stock to supply the trade promptly.

Personal.—Dr. Louis H. Bell arrived in the city this week from San Francisco, Cal. A. E. Lang, vice-president and general manager Toledo Consolidated Street Railway Company, spent this week in the city. H. T. Paiste, of Philadelphia, is making Chicago his headquarters while arranging his exhibit at the Electricity Building.

A New Incandescent Lamp will soon be put upon the market by the Star Electric Lamp Company, this city, which will be known as the new Sunbeam. The lamp is the invention of John Van Der Kammer, of Chicago, and the principal claims for this lamp are that by the use of the peculiar metallic base the all glass receiver and leading-in wire features of the Edison patent are eliminated, the process of manufacture is simplified and a more serviceable lamp produced.

Walter Lanham, a wireman employed by the Westinghouse Company at Jackson Park, was instantly killed Wednesday, this week, while trying to adjust a transformer box on the east side of the Horticultural Building. Lanham opened the cover to see if any of the arrangements within were out of order. He remarked to his companion that one of the connections seemed imperfect and at the same instant stooped over and placed his hands within the box. No sooner had he done so than he uttered a wild shriek and fell over dead, having been pierced by a thousand volt current.

Corporation Counsel Miller, denies that the ordinance of the Englewood and Chicago Electric Street Railway Company has become a law. When Mayor Washburne's message, suggesting changes in the ordinance was presented to the council, Monday night, a motion was made to reconsider the vote by which the ordinance had been passed. The clerk failed to get that action on his minutes and the ordinance and the mayor's recommendation were sent back to Committee. Parliamentarians now hold that because the minutes show no reconsideration the ordinance could not have been recommended, and therefore became law by limit of time. M. J. B.

Chicago, April 22, 1893.

GENERAL NOTES.

A new electric light plant is being put in at Hagerstown, Md.

The electric light plant at Winchester, Ill., was destroyed by fire last week; loss, $4,000.

Capt. W. L. Candee, manager of the International Okonite Company, Limited, left New York last Sunday for an extended trip through the West.

The motormen and conductors of the Gloucester, Mass., Street Railway have received a voluntary raise to $2 per day, to go into effect after May 1.

Mexican Telephone Company has elected the following directors: Robert Colgate, O. P. Dexter, R. Bacon, W. A. Paine, J. D. Sargent, W. F. Smith and J. H. Dawes.

The electric light company, of Batavia, N. Y., threatens, in case all its propositions are defeated at the coming election, to discontinue the service immediately, leaving the town in darkness indefinitely.

The capacity of the Billings electric light plant at Denver, Colo., will be increased to 70 arc lights and 3,000 incandescents. At present the plant is taxed to its full capacity and many more lights are needed.

The General Electric Company, in Rochester, N. Y., will soon receive bids for the construction of a new brick building, 100x400 feet, to be used as a machine shop. Plans for this building are now being prepared.

The Erie Telegraph and Telephone Company's sub-companies made a net increase of 187 subscribers in January and February; total number connected March 1, 15,157. Net earnings increase for the two months over the same months of last year, $9,848.

President P. P. Liebert, of the Wissahickon, Pa., Electric Railway Company, has arranged with Charles H. Davis, consulting engineer, of New York, with an office in that city, for plans and specifications for the new road, the route of which is to include Wissahickon, Roxborough, and the central part of Manayunk. Mr. Davis will superintend the construction of the line.

Death of Grosvenor Porter Lowrey.

On Thursday evening, April 20, Grosvenor Porter Lowrey, the well known and honored corporation lawyer, died of apoplexy at his home, No. 121 Madison avenue, New York. He enjoyed his usual health and had attended to his business in the morning of the day that took him from those who had loved and respected him.

Mr. Lowrey was born of Dutch parentage in North Egremont, Mass., on September 25, 1831. It was under Andrew H. Reeder, at Lafayette College, that he obtained his first knowledge of law and he was admitted to the bar in the twenty-third year of his age. Mr. Reeder was appointed Governor of Kansas when it was changed from a territory to a State and Mr. Lowrey became his private secretary when Mr. Reeder went to Kansas. During the border ruffian troubles in that State both the Governor and Mr. Lowrey were indicted for treason. They left Kansas in 1856.

In New York State during the years 1856-57, Mr. Lowrey was the Albany correspondent for the New York *Evening Post*, and the next year he entered into and formed one of the well known firm of Porter, Lowrey, Soren & Stone. In 1879, Judge Porter and Mr. Soren retired and James S. Auerbach and Richard W. Stevenson were admitted, when the firm became Lowrey, Stone & Auerbach, and this connection lasted until his death. Mr. Lowrey, in whom were associated the qualities of an excellent corporation lawyer with those of an agressive

GROSVENOR PORTER LOWREY.

and brilliant court lawyer, a rare combination, was concerned in the legal welfare of many of the largest enterprises undertaken in this city. The Western Union Telegraph Company, the elevated railroads, several of the Edison companies, Wells, Fargo & Company, the United States Express Company, the Baltimore and Ohio Railroad Company, and many other large corporations have had Mr. Lowrey as a legal advisor.

His connection with the Bell patent litigation brought him, if it were possible, into closer contact with the electrical fraternity. His last contribution to technical literature, a sketch on "The Telephone," appeared in the souvenir number of the ELECTRICAL REVIEW, February 25, 1893. He wrote considerably upon professional subjects.

Mr. Lowrey was twice married. His first wife was a daughter of Francis Tryon, to whom he was married in 1862, and in 1880 he married Miss Kate Armour, daughter of Chief Justice Armour of the Court of Queen's Bench for Ontario. He leaves a widow and seven children—five by his first wife and two by his second.

He was a member of many of the prominent clubs of this city, among them being the Manhattan, Union League and Reform clubs. The fact that he was highly esteemed by his associates in law was shown by the respect paid to his demise by the closing of several courts upon the announcement of his death.

Storage Battery Cars on Second Avenue.

On Friday afternoon, April 21, the first public trial trip of the Second Avenue Street Railway storage battery cars was made and proved a success.

The car, equipped with the Waddell-Entz storage battery and motor, the body being manufactured by Brill Brothers, rounded the curve at One Hundred and Twenty-seventh street, and started on its first trip with about 50 railroad celebrities aboard.

The batteries, 144 in number, occupy the spaces under both seats. The motor and gearing is remarkably noiseless, and the entire equipment of the car, viewed from the standpoint of a passenger, was satisfactory.

None of the storage battery cars which have been in operation heretofore has proved acceptable, the hum of the motor or the smell of the hydrogen being sufficient to condemn them in the eyes of the public, who in many cases preferred to them the present old-fashioned horse cars.

Messrs. Waddell and Entz and a corps of designers have worked together, and with their combined efforts have produced a storage battery and motor which seem to be a happy combination. The battery equipment of the cars weighs in the neighborhood of 4,000 pounds, and its capacity is 350 ampere hours. In each separate cell are several pairs of plates, which weigh, together with the case and solution, about 30 pounds each. The fact that this battery is not composed of lead, and that it has not the objectionable sulphuric acid, or hydrogen fumes, recommends it as practical. The plates are iron and copper, and the solution is an alkaline salt of zinc; the voltage of the cell is about .8.

The company has a power house at One Hundred and Twenty-seventh street, which will soon be well equipped and prepared to furnish current for the 10 cars which will be used solely between Ninety-sixth and One Hundred and Twenty-seventh streets, to the exclusion of horses.

The motor of the car is remarkably well constructed and stands considerable hard usage. No brake is used to stop the car, but by an ingenious controller device the armature is short circuited, and the field coils are left excited. The large torque that the armature possesses enables the motor to start very quickly.

One feature of this motor is the gearing on the axle, cut with involute teeth, of a bronze made by the Waddell-Entz Company, and it is a large factor that goes towards making it noiseless.

This trial trip of 31 blocks was accomplished in nine minutes, and the return to the power house in like time. On board were President George S. Hart, of the Second avenue line, with his Board of Directors, and Vice-President Charles F. Cox; E. Skitt, of the Fourth avenue line; Edwin H. Abbott, of Boston; John Langdon, of Ontario, Canada; J. H. Underhill, Percival Knath, president of the Waddell-Entz Electric Company, which owns the patents on the new motor; Montgomery Waddell, the vice-president of the company; J. B. Entz, the inventor; A. A. Whitman, treasurer; J. A. Machado, secretary, together with Clarence Whitman, Antonio Knath, Mr. Entz, Sr., and several directors of crosstown roads.

The directors of the road were perfectly satisfied with the trip, and it is possible that the entire line will be equipped with the storage battery cars, and the poor unfortunate car horse on the Second avenue line will be relegated to perhaps some easier sphere of usefulness.

It is stated that the Lynn and Boston Railroad Company has withdrawn its application to the railroad commissioners for permission to issue $1,000,000 more stock and $2,000,000 bonds, and capital will remain at $1,500,000; $1,000,000 representing the Lynn and Boston, $250,000 the Naumkeag, $200,000 the Lynn Belt Road and $50,000 the Essex, all of which have been consolidated.

Wall Street and the Electrical Stock Market.

Wall street has been in a state of feverish uncertainty for a week. This condition is due to the dilatory tactics of Secretary Carlisle in regard to financial affairs. His manifesto, noted by me last week, to the effect that he would not redeem treasury notes in gold after the surplus of the $100,000,000 was exhausted caused an immediate slump in the market. It meant practically that gold would be at a premium. On Friday he changed his programme, presumably upon the demand of President Cleveland, giving out gold that was a part of the $100,000,000 reserve for treasury notes as well as legal tenders. This reserve has now been cut into by the exports of this week. It will be necessary within a very short time for the secretary to either declare that further encroachments will be countenanced by the government, or to make a bond issue. Either line of action would have the effect of at least partially restoring confidence, which would in turn be reflected by an appreciation in stock and bond values. The market has had a downward tendency throughout the week, with sporadic rallies on covering of shorts. There is a heavy short interest and the knowledge that a bond issue of, say $50,000,000, would put up prices had the effect of dampening the ardor of the bulls, causing them to curtail operations. The result is that the few transactions are of a professional nature. The general public remains outside, content to look on and wait until the turn is unmistakably made before investing.

The gold situation is growing worse. Thus far this week we have exported $7,000,000. It is estimated by treasury authorities that $49,000,000 more will go during the summer, unless some definite policy is outlined. Shipments thus far provided for next week are $1,500,000.

ELECTRICAL STOCK MARKET.

In consideration of the pessimistic condition of affairs, it is not surprising that the electrical securities have been very quiet. There were sharp declines in one or two specialties, which will be treated later. The principal market which a great majority of these stocks has is based upon the buying of a general public for investment purposes. The average capitalist who pretends to keep abreast of the situation by reading the daily accounts of the financial situation, has become convinced that the market is a very excellent one for him to let alone. It is the history of the operations of the great number of the uninitiated that they never buy stocks until they are at or near the top. Now that values are low, they are not heard from.

General Electric was the weakest of the list. It opened on Monday at 104¼ to 105, and, under the relentless hammering of the bears, sold down to 97½ on Friday. The bear contingent issued a scarlet covered pamphlet in Boston reflecting upon the accounting made by the company in its annual report. A prompt statement from the officers of the company was to the effect that the accounting board constituted Henry L. Higginson, T. Jefferson Coolidge, Jr., H. McKay Twombly and C. H. Coster, of New York. The laws of the State of New York hold the entire board of directors accountable for its certification, consequently the stockholders may feel that the report is a fair one. The news of Judge Hallett's decision, which in the main was adverse to the company, was also made use of by the bears. This occasioned the slump to 97¼. There was steady buying on every point of the decline, and it is known that some of the stock has passed into stronger hands. There is also a large short interest in the property, which, it is believed, is not yet covered.

Edison Electric Illuminating, of New York, sold at sustained quotations through the week. It was originally designed by this company to exchange its $3,200,000 five per cent. debenture bonds for stock on July 15, providing 90 days' notice be given. This would have necessitated notice to-day. However, the company has decided to give holders of the bonds an opportunity to exchange same for the stock at any time between May 15 and June 15. This latter arrangement is of advantage to the security holder, inasmuch as it gives him immediate possession of the stock, not necessitating a wait of 90 days.

Western Union was weak throughout the period under review. The professional trading element of the street argued that the decline in Manhattan Elevated, Missouri Pacific and Texas Pacific indicated that the Gould faction was selling long stock, and the bears made the most possible use of this sentiment by putting out the short stock. The decline to 89⅛ is the lowest point reached after the advance which occurred shortly after Mr. Gould's death. Around 90 there were good supporting orders. It is believed that the decline is more out of sympathy with the general depressed situation than because of any unfavorable internal condition of the property.

The Edison Light and Power Company, of San Francisco, has declared a monthly dividend at the rate of eight per cent. per annum, payable April 15 by the New York Guarantee and Indemnity Company.

The directors of the West End Electric Company, of Boston, declared a semi-annual dividend of four per cent., payable May 1.

Bell Telephone was moderately traded in on the Boston Exchange. Something like 1,000 shares were sold in small lots. The quotation advanced from 189 to 193½, and then reacted a point. This is against 200 and over three weeks ago. The sagging is due to expiration of some of the company's patents, and the opposition which is being organized in various cities throughout the country.

ACTIVE STOCKS.

	H'g'st.	L'w'st.	Bid.	Asked.
American District Tel.	58	50⅞	58	59⅛
" Tel. & Cable	....	....	88⅛	89½
" Bell Tel.....	193⅛	189	190	190¼
General Electric.....	105	97½	99⅝	100
Do., Debenture 5's....	99	98½	....	....
Edison El. Ill., N. Y....	125	122½	121	122½
Do., 1st 5's	122¾	122½	120½	....
Western Union.....	102¾	89⅛	90	90⅛

INACTIVE STOCKS.

Telegraph.	Bid.	Asked.
Central & South American Cable ...	....	115
Commercial Cable.....	140	170
Franklin Cable..... ...	38	42
Mexican.....	....	200
Northwest Guaranty.....	104	....
Pacific & Atlantic.....	50	60
Postal Telegraph.....	....	80
Southern & Atlantic.....	78	80
Telephone.		
Erie.....	45⅛	46
Mexican.....	1.05¢	1.10¢
New York & New Jersey.....	93½	97½
New England.....	54¼	56

New York, April 22.

ELECTRIC LIGHT FLASHES.

Buchanan, Mich., will put in an electric lighting plant.

The electric light company, of Lafayette, Colo., have broken ground for their plant. It is expected to have the town illuminated in 60 days.

Nearly all the new electric lights have been placed in position in Fond du Lac, Wis., and the dynamos are now being set up. Light will probably be turned on this week.

The Eddy Electric Manufacturing Company, of Windsor, Conn., shipped the last of the 250 horse-power generators to the World's Fair at Chicago last week. The company has shipped 10 car loads of electric machinery to be used in lighting World's Fair buildings.

An electric lighting company has been organized in Hyattsville, Md. The proposed incorporators are Dr. Charles A. Wells, J. A. Blunden, F. H. Smith, W. W. Smith, Henry Morrison, Louis Wine and John E. Latimer. It is proposed to furnish incandescent lights to the town at the rate of $12 per year per lamp.

Preparations are being speedily pushed to light Rockville, Md., with electricity. Nearly all the residents have entered into the scheme with a vim that will be hard to discount. It has been determined that the capital stock of the company shall be $20,000, in shares of $100 each, the amount of the shares being made small to enable persons of limited means to contribute toward the enterprise and to share in its profits.

The "Hunting" of Parallel Alternators.

BY JAMES SWINBURNE.

Perhaps the most important discovery in alternating current work made during the last few years is that of Mr. H. E. Harrison, described by him briefly at a meeting of the Institution of Electrical Engineers on the 9th inst. Mr. Harrison, it appears, was experimenting on an alternator of the old Siemens type, which was running as a motor off the London Electric Supply Company's mains. He found that the machine did not run uniformly, but that it "hunted"; that is to say, it ran slowly a little, then it took considerable power and quickened up till it was above speed, and then ran as a generator for a few moments, and again slowed down, and so on. He also observed that the exciting current also varied, behaving like a direct current, with an alternating current of long period superadded. Mr. Harrison gave merely a preliminary account of his experiments, and is, I understand, pursuing the matter still further; nevertheless, what he has published is of enormous significance.

The phenomenon of "hunting" is not unknown in central stations, the ampere meters in some cases being so unsteady that it is difficult to gain any information from them. The electrician in charge generally informs an inquirer that the particular dynamos he uses do not run properly in parallel, and makes the best of the circumstances. I have also noticed "hunting" in parallel machines, but put it down to the beats of large slow-speed engines. That cannot be the cause in Mr. Harrison's experiments, so we must look further into the matter.

It is well known that in order to maintain oscillations the applied force must not be in step with the displacement of the mass caused to oscillate. For instance, as explained by Lord Rayleigh recently at the Royal Institution, an electrically driven tuning fork would not work if the electromagnet pulled equally, whether the dipper was entering the mercury or leaving it. Take again the pendulum of a clock acted upon by gravity. The force depends on the instantaneous position of the pendulum bob, and not on its direction of motion, so that its action is exactly in step with the displacement, and, therefore, no power is imparted to the pendulum by gravity, and gravity is, therefore, unable to keep the pendulum going. The small forces applied by the mechanism of the clock are out of step with the displacement, and they can, therefore, produce or keep up the oscillation by doing work on the pendulum at each stroke without having it all returned to the mechanism. In order to keep the pendulum going it must take more energy from the mechanism in each swing than it gives back.

Let us now turn to the alternator. Suppose it is hunting. Take the instant when it lags most; that is to say, the instant of greatest displacement. As it is neither increasing nor decreasing its lag, then it must be running at exactly the same speed as the generator, but as it lags it is running as a motor, and taking power. It is assumed for simplicity that the machine is excited normally, so as to give the same pressure as the mains, and that it has no load except its own friction. As power is given to the lagging machine, acceleration results, and the machine increases its speed and reduces the lag till it comes up to exact step with the mains. It is now acting neither as a generator nor as a motor, but as its speed is too great it gradually begins to lead and to work as a dynamo. As the lead increases, the machine gives a greater output as a dynamo, the energy given out being that involved in the increased velocity of the armature. The machine thus slows down until it reaches its maximum displacement in a forward direction. It is then for an instant at its normal speed, but it is leading and working as a dynamo, and, therefore, slowing down. It slows down until it is in step with the pressure again, but then it is going too slowly, so it over-shoots the mark and lags, and works as a motor, and so on.

Now, to produce this hunting it is necessary that the machine should do less work as a dynamo during the quarter of an oscillation in which it is leading and going faster than the station generator, than during the quarter when it is falling back from its position of maximum lead to the position of no lead; and that it should take less power as a motor during the quarter of an oscillation in which it is increasing its lag than during the quarter in which it is catching up with the station dynamo.

Now, how does this result come about in what may be called the "Harrison" effect? According to my armature reaction theory, a rotating alternating current armature may be regarded as a stationary armature carrying a direct current, placed in the position occupied by the alternating armature at its instant of maximum current. When the machine is in step the maximum current is in such a position as neither to reinforce or weaken the fields; if it lags, it weakens the fields and makes the machine act as a motor, and if it leads it strengthens the fields so that the machine works as a generator. If the machine lags, however, the fields will not respond instantly, so that they are not as weak while the machine is beginning to fall behind, as in the corresponding instant when the lag is the same, but the motor is catching-up istead of falling behind.

It must be borne in mind for the sake of clearness, that we are not dealing with the periods of alternation of the main current, of which there would be 60 or 70 per second, but of the hunting, which would be much slower. It must also be borne in mind that the machine is at its normal speed twice per vibration, and at the instants when the lag and lead are maxims. It is also in step twice per vibration, but at the instants of maximum and minimum velocity. It is thus never at the right speed and step together. Suppose now the machine has been lagging and acted as a motor and acquired extra speed, and stored some energy in extra velocity, it races ahead and acts as a dynamo. The fields do not, however, respond instantly, so that it develops less power during the time it is still racing ahead than during the time it is falling behind. The armature is thus strengthening and weakening the field once per oscillation, and the field lags a little behind, owing to its self induction, and thus satisfies the condition necessary for the production of oscillation.

It is possible that Mr. Harrison's experiment might succeed with a direct current in a stationary armature; that if started a little out of position the armature would oscillate and continue its oscillation when fed with a direct current, the fields being also excited by a direct current.

The self-induction theory of alternators will not explain the oscillations at all, as it takes no account of the weakening or strengthening of the field by the accumulated effects of the armature impulses, and cannot therefore embrace an action due to the lagging of the induction of the fields. Mr. Harrison's second experiment bears out the armature reaction theory in a remarkable way. He found the field current varied. This, I submit, was due to the varying field induction produced by the armature.

How far these actions come into play in most modern station machines is a matter of great importance. An old Siemens machine is peculiar in many ways. Its armature current produces a great deal of stray field, which does not pass through the field magnets, and might therefore be regarded as self-induction in Dr. Hopkinson's sense; and the armature resistance is very high.—*London Industries.*

The Postal Telegraph and Cable Company will in a few days begin the laying of their first conduits in Detroit. They will have their wires underground from Second street, on Fort street to Shelby street, on Shelby street north to an alley, and in the alley east to the McGraw building, where the Postal Company will have its Detroit office.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

FLUSHING, L. I.—Proposals to light the streets of the Village of Flushing, Queens County, N. Y., will be received by the Board of Trustees at their rooms in the town hall until 8 P. M. on June 6, 1893. For information and specifications apply to G. A. Roullier, village engineer, at No. 20 Main street, Flushing, L. I. Each bidder will be required to deposit with his proposal or proposals a certified check in the sum of $2,000.

CINCINNATI, O.—The Put-in-Bay and Southwestern Electric Railway Construction Company has been incorporated with a capital of $75,000. The new road is to start at Findlay and will run through Tiffin, Fostoria to the lake, and thence to Toledo. George B. Kerper is engineering the enterprise, and ex-Secretary Foster, Judge Foraker and M. B. Tillottson are also interested.

CLEVELAND, O.—Cleveland capitalists, headed by Albery Johnson, have formed a stock company and obtained a 999-year charter to build an electric railroad connecting 12 eastern Pennsylvania towns. The points in the circuit will will be Allentown, Fullerton, West Catasauqua, Catasauqua, Hokendauqua, Copley, South Allentown, Annville, South Bethlehem, West Bethlehem, Bethlehem and Easton.

PHILADELPHIA, PA.—The Delaware and Schuylkill Railway Company; capital, $50,000. Incorporators, Harry C. Forrest, Robert A. Welch, A. H. Harley and William L. Martin.

BRADFORD, PA.—The Bradford and Kendall Street Railway Company; capital, $12,000. W. S. Wales, of Bradford, is President.

NORTHAMPTON, MASS.—Members of the Springfield Street Railway Company have purchased a majority of the stock of the Northampton Street Railway Company. The latter company has just been granted permission to change to an electric line.

MILTON, PA.—The Northumberland and Allenwood Street Railway Company has been granted a franchise to build a street railway in Milton.

ORANGE, N. J.—The Suburban Traction Company has organized by electing F. W. Childs, president; H. P. Foster, treasurer; A. W. Kissam, secretary.

EVERETT, WASH.—The Everett and Snohomish Electric Railway Company has been granted a franchise to build an electric railway from Everett to Marysville and Snohomish.

RHINEBECK, N. Y.—The Rhinebeck and Rhinecliff Street Surface Railroad Company; capital, $30,000. Incorporators, A. H. Hoffman, G. Esselstyn, E. M. Harris and W. A. Tripp, of Rhinebeck; R. H. Hunter and T. J. Swift, of Poughkeepsie.

YOUNGSTOWN, OHIO.—Within 12 months Youngstown will be connected with Cleveland and Pittsburgh by an electric railway, which will be constructed by a syndicate of eastern capitalists.

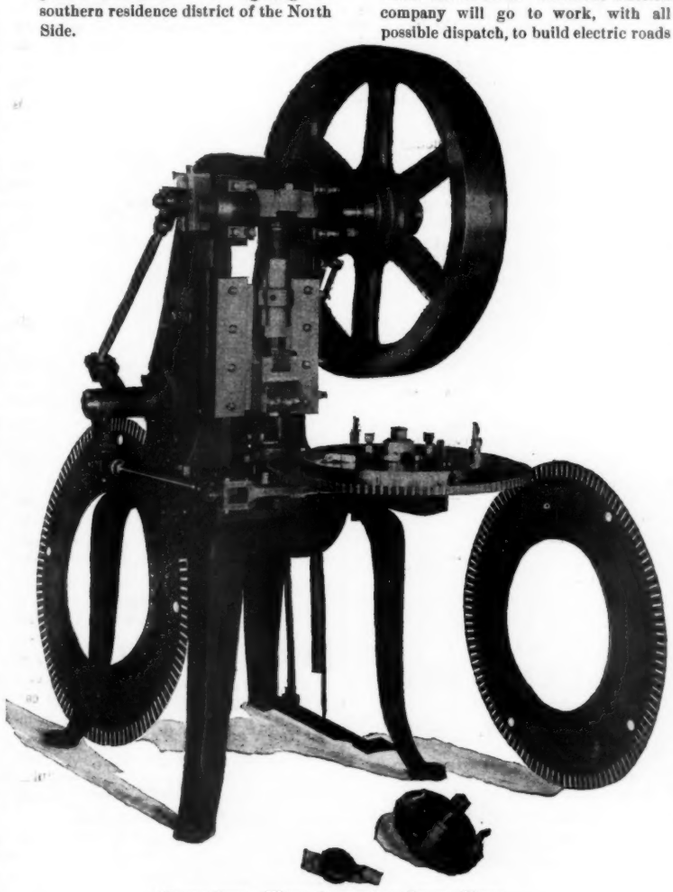
CHARLESTON, S. C.—The Enterprise Street Railway Company has applied to the city council for a franchise to operate its lines by electricity.

ASHTON, MD.—The Ashton and Clarksville Electric Railway Company has been incorporated to build an electric railroad from Ashton to Clarksville, forming part of the proposed electrical railroad from Baltimore to Washington.

GALLATIN, TENN.—A company has been formed to build an electric railway from Gallatin to Nashville, a distance of 26 miles. George Seawright and Robert Groves, of Hendersonville, are interested.

Electric Light and Power.

CHICAGO, ILL.—The Chicago, Edison and Co-operative Electric Light Companies will expend about $500,000 in equipping plants and circuits for lighting the southern residence district of the North Side.



BLISS PRESS WITH AUTOMATIC INDEX FEED.

HOGANSVILLE, GA.—The Hogansville Water Works and Electric Light Company; capital, $25,000. Incorporators, T. C. Lane, Frank Wood and R. W. Trimble.

HAGERSTOWN, MD.—Contract for supplying the city with electric light has been let to J. C. Rogers, Edward Shanley and F. H. Clements, of New York city.

LYNCHBURG, VA.—Common council committee has reported that a municipal electric light plant can be erected at a cost of $62,000.

PORT TOBACCO, MD.—C. C. Lancaster, of Washington, D. C., has purchased the summer resort at Chapel Point and will put in an electric light plant.

CHICAGO, ILL.—The Economy Electric Company; capital, $1,500,000. Incorporators, A. C. Haven, C. E. Potter and G. A. Gage.

MILFORD, MASS.—The Hopedale Electric Company will erect a new building for the manufacture of electrical parts used in the storage battery system.

HOULTON, ME.—A telephone line to connect Houlton & Hodgton is contemplated.

MT. VERNON, ILL.—The Mt. Vernon Electric Light Company; capital, $20,000. Incorporators, Allen C. Tanner, George W. Evans and Wayland S. Arnold.

HYATTSVILLE, MD.—The Hyattsville Electric Light, Heat and Power Company. Incorporators, Chas. A. Wells, W. W. Smith, Louis D. Wine, H. H. Morrison and J. A. Blundon.

NEW HAMPTON, IA.—The town has voted to grant a franchise for lighting the streets by electricity.

TALLAHASSEE, FLA.—The city council has passed an ordinance giving the Tallahassee Street Railway Company the right to construct and operate the trolley system for electric cars.

PHILADELPHIA, PA.—The People's Traction Company has closed a contract with the People's Passenger Railway Company, under the terms of which the traction company will go to work, with all possible dispatch, to build electric roads covering all of the lines. The company has $1,000,000 to push this work, and the entire cost of the new system will be $3,000,000.

WILMINGTON, DEL.—The House has passed an amendment to the charter of the City Railway Company, authorizing it to use electricity for motor power, and empowering it to borrow $2,000,000 for the extension of its railway system.

New Manufacturing Companies.

CLEVELAND, O.—The National Metal and Electrical Company has been incorporated with a capital of $25,000.

BUFFALO, N. Y.—The Beecher Single Rail Company; capital, $40,000. Incorporators, Charles A. Seaver and Lina Beecher, of Batavia; Geo. C. Hardesty and Alfred J. Hibbard, of Buffalo.

HOUSTON, TEX.—The Houston General Electric Company, capital, $30,000. Incorporators, Scott Van Etten, D. D. Colley and L. M. Kilburn.

CHICAGO, ILL.—The Copenhagen Automatic Fire Alarm Company; capital, $50,000. Incorporators, Geo. S. Knowles, H. D. Baker and George W. Ross. The company will manufacture electrical machinery and supplies.

DALLAS, TEX.—The Sutton-Steele Electric Manufacturing Company; capital, $100,000. Incorporators, W. L. Steele and N. A. Searcey.

CHICAGO, ILL.—The Abattis Electric Manufacturing Company; capital, $30,000. Incorporators, A. R. Hussey, Nelson Erickson and William Newman.

CHICAGO, ILL.—The Electrical Fire-Works and Construction Company. Incorporators, Alfred Guillaume, Emil Giroux and Elmer E. Barrett.

New Telephone Companies.

SAN FRANCISCO, CAL.—The Pacific Telephone and Telegraph Company will issue bonds in June, to the amount of $600,000, for the establishment of a direct line from San Francisco to Los Angeles. The money is also intended to provide for the completion of the underground systems in Los Angeles and Oakland.

The Use of Accumulator—Substations in Electric Lighting.

Herman Müller, writing to the *Electrotechnische Zeitschrift*, considers that in substations of this kind three points should be observed: That each cell should be perfectly accessible; that, therefore, the arrangement must be systematic; and, lastly, that the ventilation should be perfect, and any instruments or apparatus thoroughly cut off from the cell sheds. He proceeds to describe a station in Düsseldorf, one of three, which is to contain two batteries of 140 double cells arranged on a three wire system, of which one is now installed, having an output of 500 amperes. The batteries are arranged in the usual manner—to be capable of charging and discharging in parallel. The maximum pressure being 2.6 volts per cell the discharge switches have to be capable of cutting out 28 cells, in order to keep the supply at 110 volts during maximum charge. These sets of 28 cells are arranged over one another, in order to have the copper connections of simple character.

Bliss Press with Automatic Index Feed.

This machine is especially designed for cutting the notches in the circumference of armature disks for electric motors and generators. The disk is securely guided and clamped on the revolving plate, which at its lower edge has as many teeth as there are notches in the circumference of the disk. The operator starts the machine by putting his foot on the treadle, causing the disk to revolve one notch after each stroke of the cutting punch. When the last notch is cut he releases the treadle, which causes the machine to stop ready for the introduction of another disk. The machine is adjustable in diameter from 10 inches to 34 inches, and more if required. The weight of the machine is about 1,700 pounds. There are a number of these in use by the large electric companies. Any further information or particulars may be obtained of the E. W. Bliss Company, 133 Plymouth street, Brooklyn, N. Y.

The United Electric Improvement Company.

The Heisler Electric Company, of Philadelphia, has decided to very considerably enlarge the field of its operations and to extend the business beyond that so far done in the Heisler long distance series incandescent system to a general electrical manufacturing business. To that end they have acquired the control of very efficient alternating and direct current apparatus, motors, etc. In order that the name may correspond with the widening of their sphere of business, the stockholders have decided to change the name of the company from the Heisler Electric Company to the United Electric Improvement Company.

KINDRED INTERESTS

The Atlantic Improvement Co., of Long Island City, Long Island. N. Y., have placed the contract for their new power station consisting of an engine and boiler house and dynamo room with the Berlin Iron Bridge Company, of East Berlin, Conn.

Chicago Electric Wire Company.—H. B. Cobb, manager of the Chicago Electric Wire Company, of Wilmington, Del., returned last week from Chicago, whither he went to superintend the arranging of that company's World's Fair exhibit. The display consists entirely of insulated wire and is very elaborate. The wire is worth $2,000 and the exhibit represents an outlay of nearly $4,000.

The General Incandescent Arc Lamp Company, of New York, are making quite a success with their elegant little "Bijou" lamp. A considerable number of them have been bought by people who have recognized their artistic as well as useful qualities, and who have expressed themselves as pleased with them. In Baldwin's drygoods store in Brooklyn several of these lamps have been placed and are daily admired by all who have recognized the advantages which are obtained by running two and even three arc lamps in series.

Of all the Buildings under construction in New York city since January 1 for which the architects' specifications name electrical equipment, two only are using other than the interior conduit system of wiring. The metal covered conduit is now generally insisted upon by architects for the best construction. It is estimated that in the remodeled residence of Cornelius Vanderbilt, at Fifty-seventh street and Fifth avenue, 100,000 feet of brass covered interior conduit will be used by the Tucker Electrical Construction Company, who have the work in hand.

The Ball Engine Company, Erie, Pa., report the following recent shipments and state that their already large capacity is overcrowded with work:

Western Light and Power Co., Chicago, Ill., one 300 horse-power simple engine; Thomson-Houston Electric Light and Power Co., Quincy, Ill., one 350 horse-power cross compound; Ann Arbor Electric Light Co., Ann Arbor, Mich., one 300 horse-power cross compound; Alameda Street Railway Co., Alameda, Cal., two 150 horse-power tandem compound; Tampa Street Railway Co., Tampa, Fla., one 200 horse-power cross compound; Water, Light and Power Co., Nebraska City, Neb., one 100 horse-power tandem compound; Niagara Falls Street Railway Co., Niagara Falls, N. Y., one 130 horse-power simple; Pennsylvania Salt Manufacturing Co., Natrona, Pa., one 70 horse-power simple; Shoenberger & Co., Pittsburgh, Pa., one 80 horse-power simple; Gallatin Light, Power and Railway Co., Bozeman, Mont., one 150 horse-power simple; Hotel Plaisance, World's Fair, Chicago, one 100 horse-power simple; F. W. Wheeler & Co., electric lighting on steamers, three 25 horse-power simple; Cienfuegos, Cuba, one 60 horse-power simple; Everett Street Railway Co., Everett, Wash., one 200, 150, 125 horse-power cross compound; Intermountain Electric Co., Salt Lake City, Utah, one 130 horse-power simple; W. H. Kiblinger, Auburn, Ind., one 125 horse-power simple; Cohasset Electric Co., Cohasset, Mass., one 80 horse-power simple.

The Railway Equipment Company, Pullman Building, Chicago, has issued the following invitation to its friends through General Manager W. R. Mason:

Assuming that it is your intention to visit the World's Columbian Exposition, and realizing that you will be pleased while here to meet others interested in the operation of street railways, we have thought it might be a convenience for us to open a directory of visitors to the Fair.

As it will probably be also a convenience for you to meet your friends at a central and accessible point, we would be pleased to have you send to us the names of those of your company who expect to be in Chicago at that time, giving also the date of arrival, and, if possible, the hotel or apartments where you may be found. As soon after arrival as convenient, we would suggest that you call and register at our office, which is in, perhaps, the most convenient and prominent location in the city.

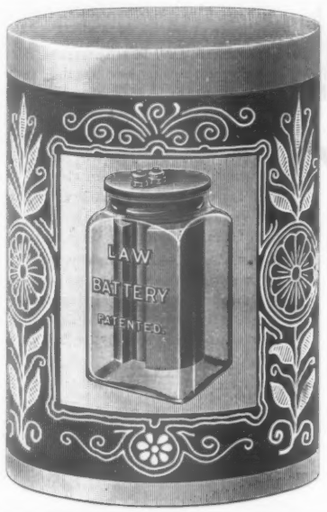
Our office is directly opposite the new Art Gallery, where the World's Fair Congress will be held, and is almost directly opposite the main depot for World's Fair trains. We shall certainly take pleasure in extending every courtesy to our friends during the six months, and we trust you will make our office your headquarters, and, if desired, have your mail addressed in our care. In the meantime we shall be pleased to furnish any information needed, as well as to attend to any matters connected with your visit to the Fair.

An Interesting Electrical Exhibit for the World's Fair.

The Electric Selector and Signal Company, of 45 Broadway, New York, will make, at the World's Fair, in the Department of Electricity, space U 19, a complete exhibit of the principle of individual electrical selection in its several applications. The space allotted to the company is a frontage of 50 feet on the main balcony, thus affording ample room for the display of its specialties.

There will be shown in operation, on a scale and under the conditions of every day practice, a number of railroad semaphores and train order signals, six telegraph stations, six arc lights, several groups of incandescent lamps, four electric motors and a telephone circuit with four or five stations. At one end of the space will be a stand representing a central light station, at which will be located the transmitter for cutting in and out the electric lights and motors, and at the other end will be a similar stand representing a railroad train dispatcher's office, from which the various signals and telegraph stations will be controlled.

The instruments and appliances, while of standard pattern, have all been finished ornamentally, and all the wood-work will be of naturally varnished wood, thus heightening the effect, and making a display which it is believed will be as attractive to the casual visitor as it will be interesting to railroad and electric light men.



Do You Need Anything in the Line of

BATTERY SUPPLIES?

We Can Quote You Bed-Rock on

Carbons, Zincs, Coppers, Jars, Sal-Ammoniac, Blue-stone, etc.

WRITE US FOR PRICES.

Law Battery Company,

85 JOHN STREET, NEW YORK.

FIDELITY CARBON MANUFACTURING CO.,

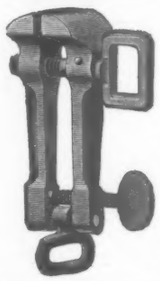
ST. LOUIS, MO.

ARC LIGHT CARBONS,

CARBON BRUSHES, PLATES & SPECIALTIES,

BATTERY CARBONS.

Sole Manufacturers Special High Grade Carbons for Ward Lamps.



The Billings Hand Vise

THE BEST VISE FOR LINEMEN

Drop Forged from Bar Steel

Interchangeable Parts *Parallel Jaws*

Hardened by Special Process

The Billings & Spencer Co.

HARTFORD CONN.

SPECIAL,

GANDELABRA

AND MINIATURE

INCANDESCENT LAMPS.

For information and prices covering Special, Candelabra and Miniature Incandescent Lamps, address the

EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT,

HARRISON, N. J.

STREET RAILS!

We will sell at a low price **185 Tons 52 lb. Girder Rails,** practically as good as new. Write or wire, at our expense, for prices.

ROBINSON & ORR,

419 Wood Street,

PITTSBURGH, - - PA.

AUCTION SALE

The Wightman Electric Manufacturing Co.'s EFFECTS,

At the Factory, Washington Ave.,

SCRANTON, PA.,

At 10 A. M., on Tuesday, April 25th,

AND FOLLOWING DAYS.

PATENT RIGHTS,

Railway Motors and Controllers, Shop Supplies, Line Supplies, Magnet Wire, Cables.

WRITE FOR CATALOGUE TO

R. E. DUNSTON, Assignee,

Box 505, SCRANTON, PA.

ENGINE CASTINGS

from one-eighth to six horse power Horizontal & Marine.

8, 16 & 60 LIGHT DYNAMO CASTINGS.

Simple Sewing Machine and Fan Motor Castings with instructions for building complete machines.

Send Stamp for Catalogue

PALMER BROS., Electrical Supplies, Mianus, Conn.

Established 1847. Purely Mutual.

INSURE IN

The PENN LIFE Company,

— OF —

PHILADELPHIA, PA.

WHY?

IT IS THE BEST!

Assets, - - $18,551,388.30

Surplus, - - 2,465,689.13

Apply for Rates to

EZRA DE FOREST, Gen'l Agent,

181 BROADWAY, NEW YORK.

THE KNOWLES ARC LAMP

For Constant Potential and Alternating Circuits.

Noiseless in operation, giving an absolutely steady and white light.

MANUFACTURED BY

THE SCHUYLER ELECTRIC COMPANY,

MIDDLETOWN, CONN.